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Treatment Plant Report

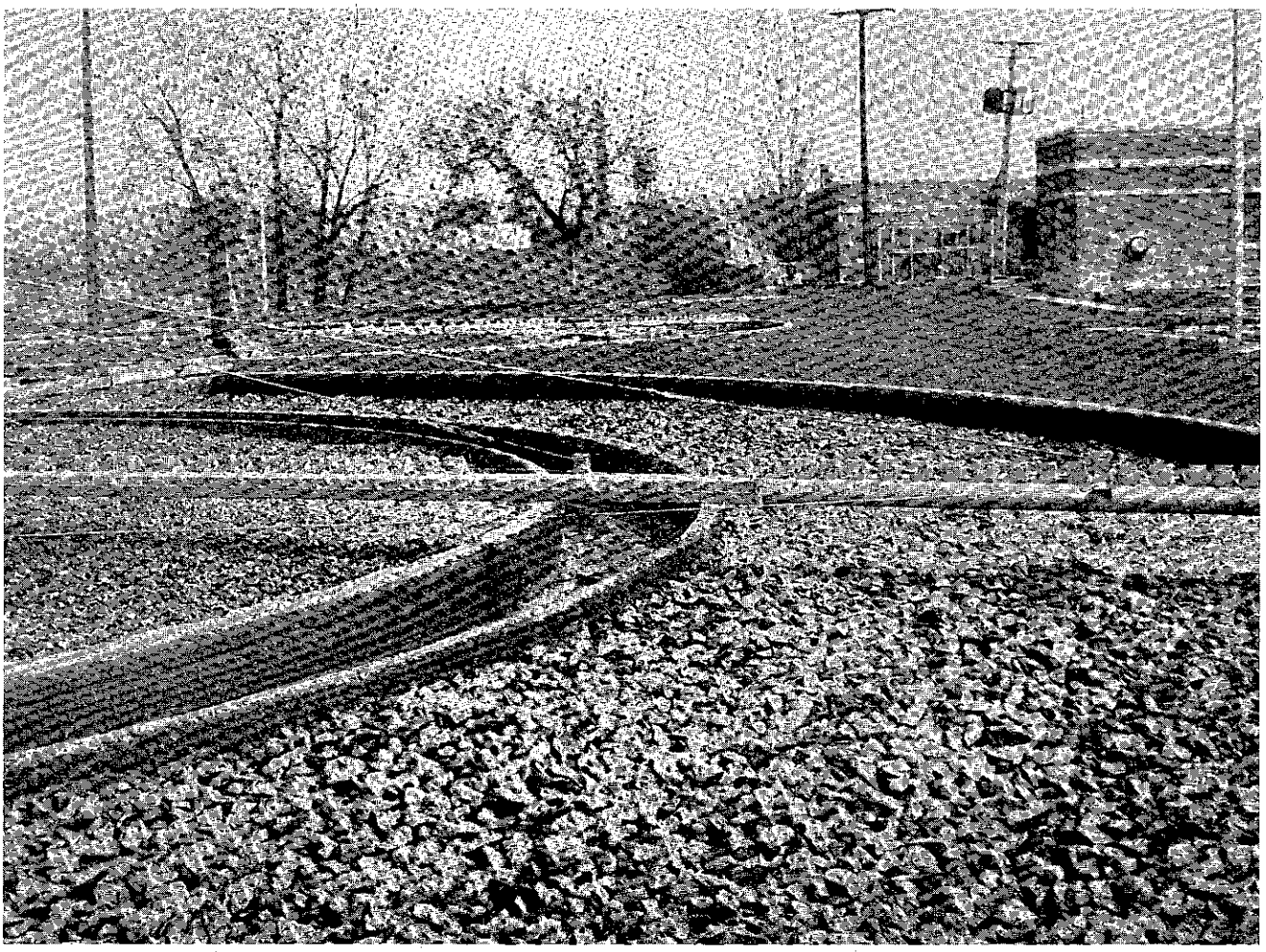

Photo by Jean Helget

METROPOLITAN
WASTE
CONTROL
COMMISSION
Twin Cities Area

1982 ANNUAL WASTEWATER TREATMENT PLANT REPORT

prepared by the

Quality Control & Operations Department
Metropolitan Waste Control Commission
350 Metro Square Building
Saint Paul, Minnesota 55101

Report No. QC 82-59

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ABBREVIATIONS AND SYMBOLS

MGD or mgd	Million Gallons per Day
mg/l	Milligrams per Liter
ug/l	Micrograms per Liter
MPN/100 ml	Most Probable Number per 100 Milliliters
NTU	Nephelometric Turbidity Units
°F	Degrees Fahrenheit
BOD	Biochemical Oxygen demand (generally means BOD_5, or Five Day Biochemical Oxygen Demand)
COD	Chemical Oxygen Demand
DO	Dissolved Oxygen
Kj-N	Kjeldahl Nitrogen
NH_3	Ammonia (nitrogen)
NO_2	Nitrite (nitrogen)
NO_3	Nitrate (nitrogen)
pH	Indicates Acidity/Alkalinity
Total P	Total Phosphorus
TSS	Total Suspended Solids
Turb.	Turbidity
>	Greater Than
<	Less Than
INF	Influent
EFF	Effluent
NPDES	National Pollutant Discharge Elimination System
Std.	Standard
Cd	Cadmium
Cr	Chromium
Cu	Copper
Hg	Mercury
Ni	Nickel
Pb	Lead
As	Arsenic
Zn	Zinc
Sn	Tin
Cn	Cyanide
gr/dscf	Grains/dry standard cubic foot
SCFM	Standard Cubic Feet per minute
DTPH	dry ton/hour
mg/kg	Milligram per kilogram

DEFINITION OF PARAMETERS

Biochemical Oxygen Demand (BOD) is a measure of the dissolved oxygen required by organisms for the aerobic decomposition of organic matter present in wastewater. A low BOD in the plant discharge is desirable because this would cause the least amount of oxygen depletion in the receiving body of water. This test normally takes five days before results are available.

Chemical Oxygen Demand (COD) is a measure of the oxygen equivalent required to chemically oxidize the organic matter present in wastewater. A low COD is desirable in plant effluent discharges. This test takes approximately three hours to complete and the results can be used to estimate BOD values. It is, therefore, extremely useful as a process control tool.

Total Suspended Solids (TSS) is a measure of the amount of particulate matter found suspended in a given amount of wastewater. Suspended solids adversely affect receiving waters by exerting an oxygen demand during decomposition or filtering out available sunlight needed by aquatic organisms for photosynthesis.

pH is a measure of the hydrogen ion concentration in a given sample of water. It is used as an indication of acidity or alkalinity. A pH of 7 is neutral - neither acid or alkaline. pH values below 6 or above 9 are usually harmful to aquatic life.

Dissolved Oxygen (DO) is a measure of the concentration of oxygen dissolved in a given sample of water. A sufficient DO level in plant effluent discharges is important because dissolved oxygen is required for the life processes of aquatic organisms.

Fecal Coliform organisms are a group of bacteria present in wastewater and are used as indicators of the possible presence of pathogenic or disease producing bacteria. Monitoring of fecal coliform organisms is also done to determine the efficiency of effluent disinfection processes.

Ammonia (NH_3), Nitrate (NO_3), and Nitrite (NO_2) are nitrogenous compounds found in wastewater. Excessive discharges of these compounds can adversely affect the receiving body of water. Degradation of NH_3 to NO_3 is an oxygen demanding reaction. Monitoring of nitrogenous compounds is also useful for controlling secondary treatment processes.

Phosphorus (P) is monitored because it also can have adverse effects on the receiving body of water. When discharged in sufficient quantities it aids in stimulating excessive and undesirable algal growth.

DEFINITION OF PARAMETERS CONT.

Heavy Metals covered in this report include the following: copper (Cu), chromium (Cr), zinc (Zn), lead (Pb), cadmium (Cd), mercury (Hg), nickel (Ni), arsenic (As), and tin (Sn). Close monitoring of heavy metals is necessary due to their possible toxicity to aquatic organisms present in the receiving waters.

1.0 SUMMARY

During 1982, the Commission operated fourteen wastewater treatment plants. The performance of these facilities is related to: (1) the effluent quality of each plant and the record of compliance with NPDES permit conditions; (2) the quality of air emissions from sludge incineration at two regional plants; and (3) management of sludge generated at each plant as a result of wastewater treatment. The purpose of this report is to summarize the performance of Commission treatment plants during 1982 by presenting and analyzing data generated to monitor these major areas.

1.1 Effluent Quality

Table 1-1 is a summary of average annual effluent quality at each plant. Annual average effluent BOD was below permitted discharge limitations at all plants. Annual average effluent TSS were below permitted discharge limitations at all plants except the Hastings Plant. At Bayport, Rosemount, and Stillwater, annual average effluent phosphorus was below the limit of 1 mg/L. At Empire, annual average effluent ammonia was below the limit of 1 mg/L.

One of the most important indicators of performance of individual treatment plants, and performance of the Commission in the operation of all plants, is compliance with NPDES permit limitations. Table 1-2 summarizes the trend in NPDES permit compliance for the period of NPDES administration, 1974-1982. During this period, the number of plants operated by the Commission was reduced from 21 in 1974 to its present number of 14. The total number of violations was reduced from 163 in 1974 to 30 in 1982. Overall percent compliance with NPDES permit limitations improved from 86.4% in 1974 to 98.3% in 1982.

Individual NPDES compliance records of the fourteen plants currently in operation are given for the period 1977-1982 in Table 1-3. In general, performance at each plant improved significantly through the period 1977-1980, and remained relatively constant from 1980-1982. The number of permit violations decreased from 35 in 1981 to 30 in 1982.

Trends in plant performance can also be evaluated by examining the two major effluent parameters, BOD and TSS, in the form of a single performance indicator (BOD + TSS). Figure 1-1 shows these trends for the Metropolitan Plant alone, and for all other plants combined. Performance at the Metropolitan Plant has been somewhat erratic in the past, with particularly poor performance in 1976 and 1979. NPDES permit limitation levels were eased in 1977 and in 1978 in recognition of reduced plant performance capabilities. During the period of 1980-1982, NPDES permit limitations for the Metropolitan Plant approached and equaled secondary treatment levels (BOD = 25 mg/L and TSS = 30 mg/L or BOD + TSS = 55 mg/l) while performance was consistently better than secondary treatment.

TABLE 1-1

1982 ANNUAL SUMMARY OF TREATMENT PLANT EFFLUENT QUALITY

Treatment Plant	Wastewater Flow mgd		1982 Percent Removal		BOD mg/l			TSS mg/l		Fecal Coli. Geometric Mean MPN/100 ml		Nutrients, mg/l Phosphorus		Ammonia		Turbidity NTU		Dissolved Oxygen mg/l	
	Design*	1982 Avg.	BOD	TSS	NPDES Limit	1982 CBOD Avg.	1982 TBOD Avg.	NPDES Limit	1982 Avg.	NPDES Limit	1982 Avg.	NPDES Limit	1982 Avg.	NPDES Limit	1982 Avg.	NPDES Limit	1982 Avg.	NPDES Limit	1982 Avg.
Anoka	2.46	2.14	95	95	25	12	14	30	8	200	48	---	3.7	---	15.8	25	5	----	1.1
Bayport	0.65	0.52	95	94	25	8	10	30	8	200	5	1.0	0.5	---	3.4	25	4	----	3.7
Blue Lake	20.00	16.1	95	97	25	10	24	30	7	200	16	---	3.8	---	13.9	25	7	----	11.3
Chaska	1.40	0.80	93	93	25	14	20	30	11	200	5	---	1.7	---	9.6	25	5	----	9.0
Cottage Grove	1.80	1.26	95	96	25	10	14	30	7	200	11	---	5.3	---	11.3	25	4	----	6.1
Empire	6.00	4.05	99	99	10	2	3	10	1	200	1	---	7.1	1.0	0.7	25	1	>4.0	8.9
Hastings	1.83	1.50	92	87	25	20	31	30	31	200	21	---	4.5	---	17.6	25	12	----	6.0
Maple Plain	0.22	0.35	90	94	25	13	15	30	7	200	14	---	2.8	---	13.6	--	9	----	5.8
Medina	0.10	0.149	87	88	--	14	17	--	14	---	--	---	2.7	---	11.4	--	8	----	3.4
Metropolitan	250	208	95	95	24	13	22	30	11	200	24	---	2.0	---	14.9	--	6	----	3.1
Rosemount	0.60	0.31	90	99	25	16	18	30	2	200	2	1.0	0.3	---	29.0	25	5	----	6.2
Savage	0.86	0.48	94	97	25	8	9	30	4	200	34	---	3.8	---	1.5	25	5	----	9.0
Seneca	24.00	14.7	92	90	25	18	24	30	19	200	7	---	3.4	---	18.9	25	8	----	8.0
Stillwater	3.02	2.61	93	94	25	10	17	30	8	200	5	1.0	0.4	---	10.6	25	5	----	5.1

*Represents NPDES permitted flow. See text of report for discussion of design flow capacity.

TABLE 1-2

TRENDS IN NPDES PERMIT COMPLIANCE

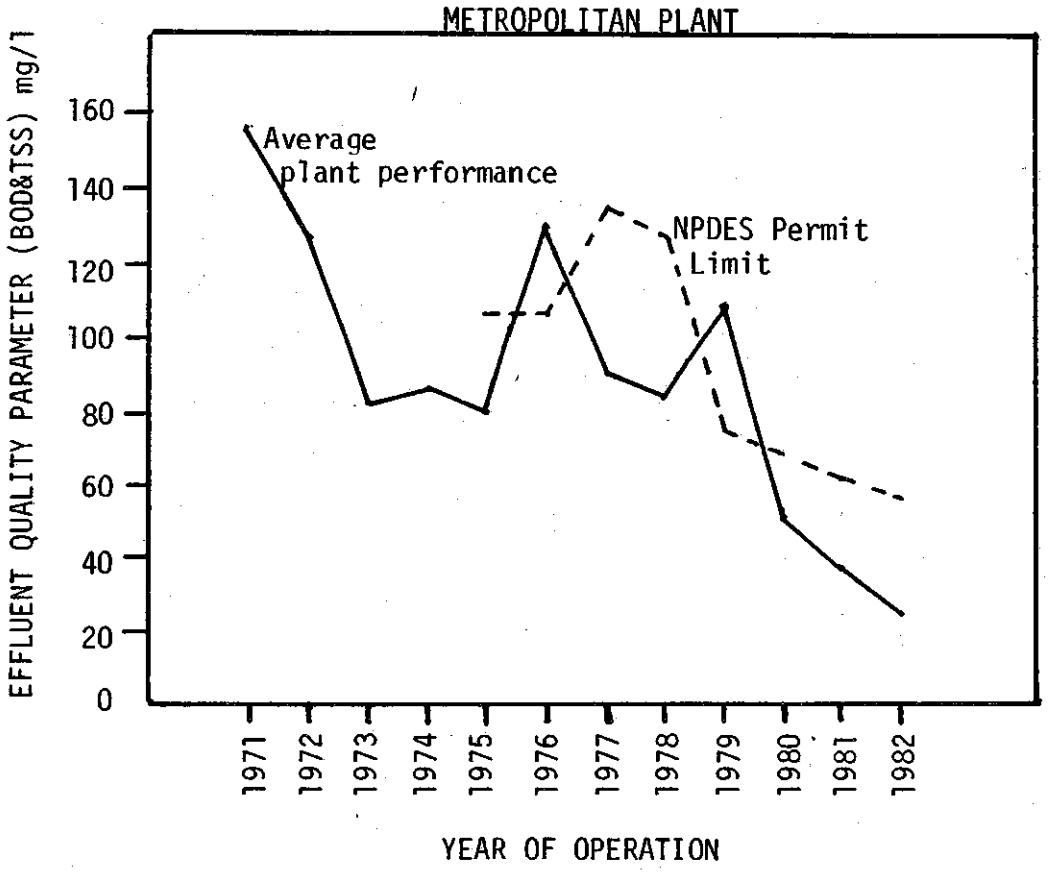
Year	Number of Plants In Operation (at Year-End)	Number of Violations	Percent Compliance
1974	21	163	86.4
1975	20	81	94.5
1976	20	109	92.7
1977	20	101	93.6
1978	18	94	94.5
1979	16	109	93.8
1980	14	36	98.0
1981	14	35	98.0
1982	14	30	98.3

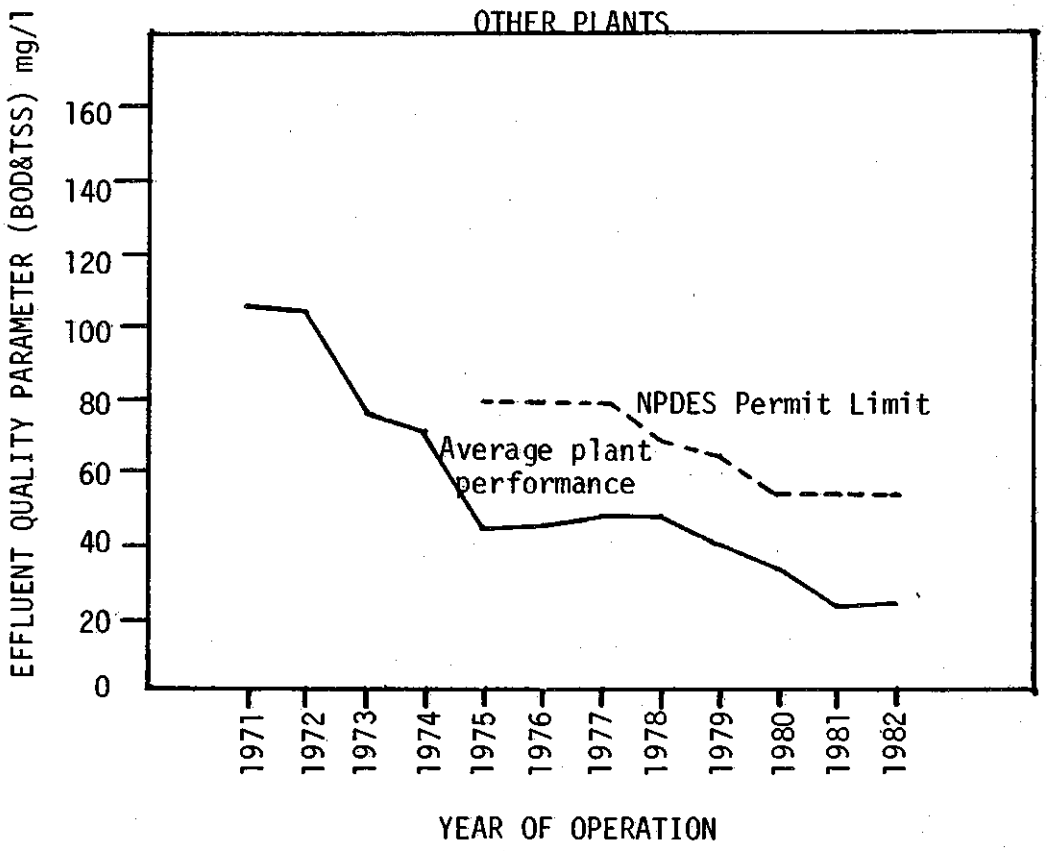
TABLE 1-3

NPDES PERMIT COMPLIANCE AT EXISTING PLANTS

TREATMENT PLANT	ANNUAL NUMBER OF VIOLATIONS (V) AND PERCENT COMPLIANCE (C)											
	1977		1978		1979		1980		1981		1982	
	V	C	V	C	V	C	V	C	V	C	V	C
ANOKA	13	90	27	90	3	97	3	99	8	97	2	99
BAYPORT	2	99	0	100	0	100	0	100	0	100	0	100
BLUE LAKE	0	100	1	99	0	100	0	100	0	100	0	100
CHASKA	4	92	15	69	25	58	4	96	3	98	1	99
COTTAGE GROVE	2	96	3	94	4	95	1	99	4	96	1	99
EMPIRE	--	---	--	---	1	90	1	99	0	100	3	98
HASTINGS	7	95	2	98	2	99	5	97	8	94	18	87
MAPLE PLAIN	2	97	2	97	--	95	3	95	1	99	2	96
MEDINA	0	100	0	100	1	92	0	100	2	83	0	100
METROPOLITAN	2	96	6	88	15	69	2	96	5	89	0	100
ROSEMOUNT	4	93	1	99	1	99	1	99	0	100	1	99
SAVAGE	6	88	2	96	6	92	0	100	0	100	1	99
SENECA	5	97	5	97	8	94	0	100	2	99	1	99
STILLWATER	1	99	0	100	0	100	2	99	2	99	0	100
TOTALS	48	96	64	94	74	95	22	99	35	98	30	98

FIGURE 1
TRENDS IN PLANT PERFORMANCE
1971-1982





Other plants show a trend of improved performance throughout 1971-1981, with marked improvement in 1971-1975, and 1979-1981. NPDES permit limitations became more stringent between 1975-1980. In 1982, NPDES permit limits were at the secondary treatment level (BOD = 25 mg/L and TSS = 30 mg/L) or better at all plants.

1.2 Air Emissions

There are four major sources of air emissions at the Metropolitan and Seneca Plants: Metropolitan F & I No. 1 sludge incinerators, Metropolitan F & I No. 2 sludge incinerators, Metropolitan scum incinerator, and Seneca sludge incinerators. Each source is limited in discharge of particulates, opacity and odors. Sludge incinerators also have a limit on mercury emission.

Table 1-4 is a summary of sludge and scum incinerator emissions measured during 1982. At the Metropolitan Plant F & I No. 1 and Seneca Plant, compliance with particulate, opacity, and mercury standards were demonstrated to be acceptable. At the Metropolitan Plant Scum Incinerator, annual average particulate emissions and opacity slightly exceeded emission standards. Excursion of standards was due to the efforts of minimizing stack emissions and maintaining significant incinerator loadings by experimental operation of the incinerator/scrubber system after installation. Incinerators in Metropolitan Plant F & I No. 2 remained inactive during 1982 as incinerator and scrubber renovation continued. Incinerators in Metropolitan Plant F & I No. 1 were shutdown on September 19, and all sludge generated at the Metropolitan Plant was disposed of by land application or composting.

1.3 Sludge Management

Each of the fourteen plants operated by the Commission produces sludge as a result of wastewater treatment, and with the exception of Medina, each plant provides some form of sludge processing leading to ultimate disposal of the sludge. Table 1-5 is a summary of sludge generated at Commission plants.

Ultimate disposal of sludge generated at Commission plants involves either landspreading or incineration. The Metropolitan Plant and the Seneca Plant represent major points of final sludge disposal. At the Metropolitan Plant, sludge is either landspread or incinerated; at Seneca, sludge is incinerated. The Empire Plant has on-site sludge landspreading facilities; all other plants transport sludge to the Metropolitan or Seneca Plant, or directly to landspreading sites.

TABLE 1-4

SUMMARY OF 1982 INCINERATOR EMISSION QUALITY

Source	Mercury				Particulate				Opacity			
	Emission std. g/24 hr.	Annual Avg. g/24 hr.	No. of Tests	Percent of Tests Mtg. Stds.	Emission std. g/dscf	Annual Avg. gr/dscf**	No. of Tests	Percent of Tests Mtg. Stds.	Opacity Std., %	Annual Avg. Opacity, %	No. of Tests	Percent of Tests Mtg. Stds.
Metro, F & I No. 1	3200	452	2	100	0.1	0.08	5	100	20	7	75	92
Metro Scum Incinerator***	----	---	-	---	0.2	0.24	9	22	20	17	5	60
Seneca	3200	137	2	100	0.2*	0.20	7	71	20	13	34	76

* Seneca incinerators were derated from 1.4 DTPH to 1.0 DTPH on November 1, 1981, resulting in an increase in the particulate emission standard to 0.2 gr/dscf at 12% CO2.

** Grains/dry standard cubic foot corrected to 12% CO2.

***During 1982, scrubber installation on the Scum Incinerator was completed. The annual averages listed above reflect experimentation with various modes of incinerator/scrubber operation. Emission standard is based on a feed rate of 1100 lbs/day.

TABLE 1-5

SUMMARY OF SLUDGE GENERATED, 1982

TREATMENT PLANT	ANNUAL WASTEWATER FLOW		ANNUAL SLUDGE PRODUCTION			SLUDGE DISPOSAL METHOD
	MGD	MG	MG	% SOLIDS	DRY TONS	
ANOKA	2.14	781	3.99	1.78	295	(1)
BAYPORT	0.52	190	1.24	2.15	112	(1)
BLUE LAKE*	16.1	5,876	37.12	4.92	7,594	(1) (2)
CHASKA	0.80	292	2.64	1.59	175	(3)
COTTAGE GROVE	1.26	460	3.48	1.63	234	(1) (4)
EMPIRE	4.05	1,478	-----	13.2	544	(4)
HASTINGS	1.50	548	2.76	3.18	350	(1) (4)
MAPLE PLAIN	0.35	128	0.06	5.94	15	(1) (4)
MEDINA	0.15	55	0	-----	0	-------
METROPOLITAN*	208	75,920	-----	28.7	81,767	(4) (5)
ROSEMOUNT	0.31	113	1.45	10.33	618	(1)
SAVAGE	0.48	175	0.25	4.88	47	(2) (4)
SENECA*	14.7	5,365	-----	23.5	12,402	(5)
STILLWATER	2.61	953	5.05	2.68	563	(1) (4)

SLUDGE DISPOSAL METHODS:

(1) Transported to Metropolitan Plant for further proccessing

(2) Transported to Seneca Plant for futher processing

(3) Transported to Blue Lake Plant for further processing

(4) Landspreading

(5) Incineration

NOTES:

*Annual Sludge Production includes sludge transported from other plants for further processing, and chemicals added for sludge conditioning (where applicable).

2.0 INTRODUCTION

The Metropolitan Waste Control Commission was established as the areawide operational water pollution control agency by the Minnesota State Legislature, through the Metropolitan Sewer Act in 1969. This Act gives the Commission formal charge to prevent, abate, and control water pollution in lakes, rivers, and streams of the seven county Metropolitan area. The accomplishment of these responsibilities required that the Commission acquire, construct, operate, and maintain all interceptors and treatment works necessary for the collection, treatment, and disposal of wastewater in the area.

The Commission originally acquired 33 existing wastewater treatment plants in 1970. During the following ten years, the Commission reduced the number of plants in operation to 14, by constructing three new plants and closing 22. The number of plants in operation at the end of each year is shown graphically in Figure 2-1. A history of each plant is summarized in Table 2-1. Through this program of regionalization, the Commission eliminated old and outdated plants which could not comply with more stringent modern effluent limitations. New and modern plants were designed and constructed to economically meet required effluent limitations, and provide for expansion to accomodate future growth in the area.

The 14 plants currently operated by the Commission include the Metropolitan Plant. This is the largest plant in the system and serves the greater Minneapolis-St. Paul area. Three other regional plants, Blue Lake, Empire, and Seneca, each serve several suburban communities. The remaining ten smaller plants generally serve individual communities in the area.

Throughout each year, the performance of each plant is monitored, recorded, and reported to regulatory agencies, Commission administrators, and Commission program managers, in order to insure consistently good performance and indicate areas where additional effort is necessary to improve performance. At the end of each year, the record of performance of each of the Commission's Plants is summarized. This report is a summary of treatment plant performance during 1982.

The purposes of this report are as follows:

(1) To provide a summary of 1982 treatment plant performance data for future reference;

(2) To compare plant effluent quality to NPDES permit effluent limitations;

(3) To compare effluent quality to plant and administrative program performance goals;

(4) To compare major air emissions to emission standards;

(5) To summarize quantity and quality of sludge production and methods of sludge treatment and disposal at each plant;

FIGURE 2-1

NUMBER OF TREATMENT PLANTS IN OPERATION
1970-1982

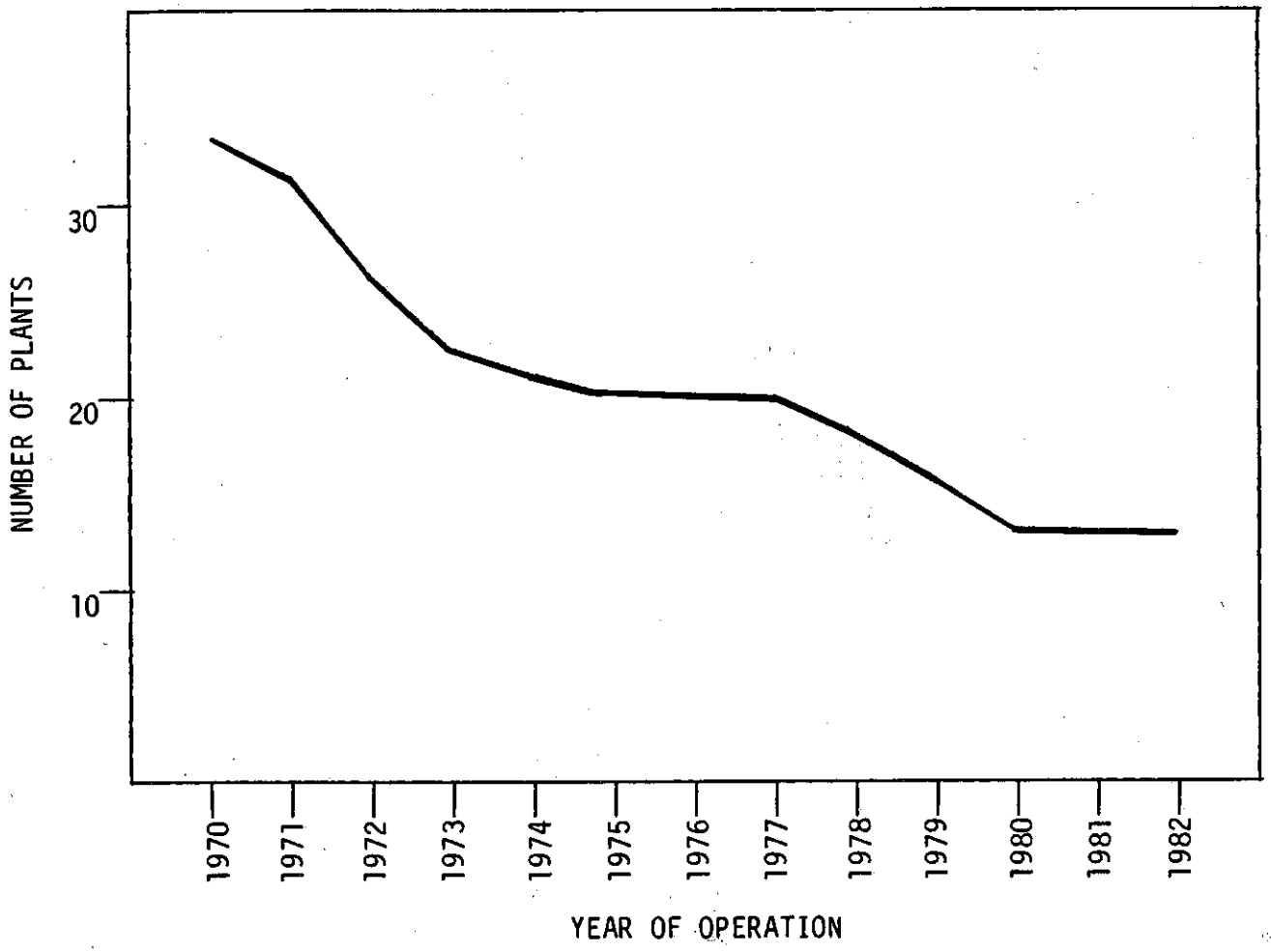


TABLE 2-1

TREATMENT PLANTS IN OPERATION DURING THE PERIOD IN 1971-1982

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
ANOKA	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX
APPLE VALLEY	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXX (Flow diverted to Empire Plant 9/79)			
BAYPORT	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX
BLUE LAKE	(Plant Start-up 8/71)XXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX
BURNSVILLE	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXX (Flow diverted to Blue Lake 9/22/72)										
CHASKA	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX
CHANHASSEN	XXXXXXXXXXX	XXXXXXXXXXX	X (Flow diverted to Blue Lake Plant 1/10/72)										
COTTAGE GROVE	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX
EAGAN TOWNSHIP I	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXX (Flow diverted to Seneca Plant, 7/21/72)										
EAGAN TOWNSHIP II	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXX (Flow diverted to Seneca Plant, 7/21/72)										
EMPIRE									(Plant Start up 9/79) XXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	
EXCELSIOR	XXXXXXXXXXX	XXXXXXXXXXX	XX (Flow diverted to Blue Lake Plant 2/28/72)										
FARMINGTON	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXX (Flow diverted to Empire Plant 9/79)			
FOREST LAKE TOWNSHIP	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXX (Flow diverted to Metropolitan Plant 9/28/72)										
FOREST LAKE VILLAGE	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXX (Flow diverted to Metropolitan Plant 9/28/72)										
HASTINGS	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX
INVER GROVE HEIGHTS	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX (Flow diverted to Metropolitan Plant 11/8/72)										
LAKEVILLE	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXX (Flow diverted to Empire Plant 9/79)			
LONG LAKE	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXX (Flow diverted to Blue Lake Plant 6/80)		
MAPLE PLAIN	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX
MEDINA	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX
METROPOLITAN	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX
MOUND	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXX (Flow diverted to Blue Lake Plant 5/74)								
NEWPORT	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXX (Flow diverted to Metropolitan Plant 6/11/75)							
OAK PARK HEIGHTS	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXX (Flow diverted to Stillwater Plant 7/11/73)									
ORONO	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXX (Flow diverted to Blue Lake Plant 6/80)		
PRIOR LAKE	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXX (Flow diverted to Blue Lake Plant 5/78)				
ROSEMOUNT I	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXX (Flow diverted to Rosemount II 11/20/73)									
ROSEMOUNT II			(Plant Start-up 11/73) XX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX
ST. PAUL PARK	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXX (Flow diverted to Metropolitan Plant 6/18/75)							
SAVAGE	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX
SENECA	(Plant Start-up 7/72) XXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX
SHAKOPEE	XXXXXXXXXXX	XXXXXXX (Flow diverted to Blue Lake Plant 7/71)											
SOUTH ST. PAUL	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXX (Flow diverted to Metropolitan Plant 6/24/74)								
STILLWATER	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX
VICTORIA	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXX (Flow diverted to Blue Lake Plant 11/7/73)									
WACONIA						(Plant acquired 11/75) XX	XXXXXXXXXXX	XXXXXXXXXXX	X (Flow diverted to Blue Lake Plant 1/78)				
WAYZATA	XXXXXXXXXXX	XXXXXXXXX (Flow diverted to Blue Lake Plant 10/71)											

(6) To summarize activities related to plant performance at each plant; and

(7) To compare 1982 plant performance data to historical performance data.

This report is divided into seven major sections. Sections 1 and 2 are a summary and introduction, respectively. Section 3 discusses plant effluent quality relative to NPDES effluent limitations and performance goals. Section 4 discusses air emissions from the four major sources at the Metropolitan and Seneca Plants. Section 5 summarizes plant sludge production and sludge quality. Section 6 consists of individual treatment plant reports giving details of plant treatment processes, plant efficiencies, plant loadings, and 1982 activities at each plant. Section 7 is an appendix which presents additional data and data analyses in several forms.

3.0 EFFLUENT QUALITY

3.1 Water Pollution Control Regulations

In October, 1972, Congress passed the Water Pollution Control Act Ammendments of 1972 (Public Law 92-500). The purpose of the Act was to enhance the quality and value of water resources and to establish a national policy for the prevention, control, and abatement of water pollution. The U.S. Environmental Protection Agency (EPA) was established as the agency to administer and regulate the requirements of the Act. The national goals established for publicly owned treatment works were the attainment of a minimum of secondary treatment standards by July 1, 1983, and additional treatment standards based on receiving water quality. Congress amended Public Law 92-500 by the Clean Water Act of 1977, and the Municipal Wastewater Treatment Construction Grant Amendments of 1981. These amendments eased the compliance date for secondary treatment standards and water quality related effluent limitations to July 1, 1988.

To meet adopted receiving water quality standards stated in 6 MCAR § 4.8014 and 6 MCAR §4,8015, the Minnesota Pollution Control Agency's Rules and Regulations also establish secondary treatment as a minimum treatment level for all publicly owned treatment plants. Secondary treatment facilities are defined, in these Rules and Regulations, as works which will provide effective sedimentation, biochemical oxidation and disinfection, or the equivalent, including effluents conforming to the limits shown in Table 3-1.

TABLE 3-1

DEFINITION OF SECONDARY TREATMENT EFFLUENT - 6 MCAR 4.8014-4.8015

Substance or Characteristic	Limiting Concentration or Range	
	30 Day Mean	7 Consecutive Day Mean
5-Day Biochemical Oxygen Demand, mg/L(1)	25	45
Fecal Coliform Group Organisms, Number/100 mL(2)	200	400
Total Suspended Solids, mg/L(1)	30	45
Phosphorus, mg/L(3)	1	---
Turbidity, mg/L(1)	25	---
pH Range(4)	6.5-8.5	---
Unspecified Toxic or Corrosive Substances(5)	---	---

(1) Arithmetic Mean
(2) Geometric Mean; Disinfection required from March 1 through October 31.
(3) In effect where discharge is directly to lake or reservoir.
(4) Not subject to averaging.
(5) None allowed at levels acutely toxic to humans or other animals or plant life.

Where it is evident that the concentration levels specified in Table 3-1 are not effective in preventing pollution, or the specified stream flow is inadequate to protect the applicable water quality standards, effluent standards more stringent than those specified in Table 3-1 may be adopted. As such, specific water quality based effluent limitations have been adopted for the Vermillion River, and are applied to the Empire Plant. These limitations are listed in Table 3-2.

TABLE 3-2

WATER QUALITY BASED EFFLUENT STANDARDS (WPC-41)

Substance or Characteristic	Limiting Concentration or Range
5-Day Biochemical Oxygen Demand, mg/L(1)	10
Fecal Coliform Group Organisms, Number/100 mL(2)	200
Total Suspended Solids, mg/L(1)	10
Phosphorus, mg/L(3)	1
Turbidity, mg/L(1)	25
pH Range(4)	6.5-8.5
Ammonia as Nitrogen, mg/L(1)	1
Dissolved Oxygen, mg/L(1)	4
Unspecified Toxic or Corrosive Substances(5)	---

(1) Arithmetic Mean
(2) Geometric Mean; Disinfection required from March 1 through October 31.
(3) In effect where discharge is directly to lake or reservoir.
(4) Not subject to averaging.
(5) None allowed at levels acutely toxic to humans or other animals or plant life.

During 1974, the National Pollutant Discharge Elimination System (NPDES) was established as the major regulatory tool to be used in implementing the requirements of Public Law 92-500. Under this system, each individual wastewater discharge to state or federal waters is required to have an NPDES permit. The NPDES permit places limitations on the quantity and quality of the wastewater discharge. After establishment of initial policies and procedures, the EPA transferred the responsibility for issuing permits to individual state governments.

3.2 Effluent Limitations

In 1974, all Commission Plants were issued discharge permits by the MPCA. The permits stipulated interim effluent quality standards to be achieved for compliance with permit conditions. Effluent quality standards established for each plant were the same as, more stringent than, or less stringent than those of secondary treatment depending on the water quality standards of the receiving waters and the practicability of attaining certain levels of treatment under existing operating conditions.

These standards have been revised in the past and will be revised in the future as receiving water quality standards change, and as facilities are constructed capable of achieving higher levels of treatment.

This standards revision process was experienced by the Commission during 1982, when the MPCA approved a new five-year NPDES Permit for the Metropolitan Plant as a reissuance of the old permit which expired on June 30, 1982. The action by MPCA represents the culmination of a process which began more than a year ago and which involved a lengthly public hearing on the provisions of the new permit. Whereas, the old NPDES Permit contained provisions to attain and to maintain compliance with secondary treatment standards, the new permit considered effluent limitations and compliance schedules to meet water quality standards for the Mississippi River. Specifics of the new Metropolitan Plant permit are addressed in Section 6 of this report. Permit revision and renewal can be expected for several of the Commission's plants during 1983. The NPDES effluent quality limitations in effect during 1982 are shown in Table 3-3.

3.3 Plant Performance

During 1982, the Commission's network of treatment plants had available capacity to treat 114 billion gallons of wastewater (312 mgd). The actual volume of wastewater treated during 1982 was approximately 92 billion gallons (253 mgd). This represents an increase of wastewater volume from the previous year of approximately 4 billion gallons. Wastewater treated during 1982 represented 81 percent of the Commission's total treatment capacity.

Of the 92 billion gallons of wastewater received during 1982, 82 percent was treated at the Commission's largest facility, the Metropolitan Wastewater Treatment Plant. Approximately 12 percent of the total flow was divided between the next two largest facilities, Blue Lake and Seneca.

During 1982, the Commission's laboratories began to measure and report both carbonaceous BOD (CBOD) and total BOD (TBOD). Measurement of the CBOD eliminates misleading data which is sometimes obtained due to nitrification occurring in the standard or total BOD test. Nitrification is an oxygen consuming process and, therefore, tends to increase the BOD value. Comments made regarding 1982 treatment plant performance, for the most part, draw upon CBOD data and should be viewed with consideration for the fact that there are differences between the test procedures. TBOD and CBOD effluent data are tabulated for each plant in Section 6 of this report.

At the Metropolitan Plant, effluent quality during 1982 improved from that of 1981. Average effluent CBOD and TSS concentrations during 1982 were 13 mg/L and 11 mg/L, as compared to 1981 average effluent BOD and TSS values of 19 mg/L and 19 mg/L, respectively. Removal efficiencies for BOD and TSS increased from 91 percent for BOD and 92 percent for TSS in 1981, to 95 percent for BOD and 95 percent for TSS in 1982. This is the third consecutive year that the Metropolitan Plant has shown significant improvement.

Effluent quality for plants other than the Metropolitan Plant also improved during 1982. Annual average effluent CBOD and TSS concentrations during 1982 were 12 mg/L and 10 mg/L as compared to 1981 annual average BOD and TSS values of 15 mg/L and 11 mg/L.

The annual average BOD removal efficiency for all plants increased from 91 percent in 1981 to 93 percent in 1982, and the TSS removal efficiency increased from 92 percent in 1981 to 95 percent in 1982.

Figure 1-1, located in the first section of the report, illustrates the trend in NPDES compliance for the years 1971 through 1982, for both the Metropolitan Plant and other plants. It can be seen from Figure 1-1, that excellent plant performance continued during 1982 and that effluent BOD and TSS have been significantly reduced in 1982 for the Metropolitan Plant and slightly reduced at other plants. The annual average effluent concentration (BOD and TSS) has been below permissible NPDES discharge limits for the Metropolitan Plant during the past three years, while the annual average effluent concentration (BOD and TSS) for all other plants has been consistently below permissible NPDES discharge limits since 1975.

Annual performance and monthly variations in performance at each treatment plant are summarized in Table 3-4. Plant flow and major effluent quality parameters are included in the summary.

Nominal design flow for each plant is included in each NPDES permit, as shown in Table 3-4. While it is normal practice to compare average annual flow to nominal design flow when relating current plant operation to plant capacity, this practice is often deceiving. Nominal design flow must be adjusted to reflect unique flow variation factors, organic loading and organic load variation factors, and individual unit process capacities, in order to be an accurate indicator of plant capacity. These flow and loading variations can vary from year to year, depending on changes in infiltration/inflow (precipitation related) and activities of local industries.

It is not within the scope of this report to analyze and define realistic current plant capacities. Treatment plant capacities will be evaluated on an ongoing basis and periodically summarized in separate reports. However, the following summary of realistic capacity versus nominal design capacity of several plants is necessary in order to understand subsequent discussions of plant performance in 1982.

Anoka: Current plant capacity has been determined to be slightly less than 2.46 mgd, due to existing activated sludge aeration and sludge processing limitations.

Bayport: Plant capacity is somewhat less than nominal design capacity (0.65 mgd), due to chemical feed which was added for phosphorus removal subsequent to the original plant construction. This addition has reduced activated sludge and sludge processing capacity.

Chaska: Plant capacity is somewhat less than nominal design capacity (1.4 mgd) due to high and variable organic loadings. At current organic loading concentrations, plant capacity is about 1.0 mgd.

Hastings: Current plant capacity has been determined to be approximately 1.5 mgd (instead of 1.83 mgd), due to final clarification and sludge processing limitations.

Stillwater: Plant capacity is somewhat less than nominal design capacity (3.02 mgd), due to the addition of a phosphorus removal system. This addition has reduced activated sludge and sludge processing capacity.

Table 3-4 indicates that Maple Plain and Medina are currently operating beyond their plant capacity. Based on realistic plant capacities discussed above, Anoka, Bayport, Chaska, Hastings, and Stillwater are also currently operating at or near plant capacity.

Average annual effluent CBOD compared favorably with monthly effluent limitations at all plants. The monthly average effluent CBOD values exceeded NPDES effluent limitations at Hastings and Maple Plain, resulting in a total of five monthly CBOD violations. Average annual effluent TSS compared favorably with monthly effluent limitations at all plants. Monthly average effluent TSS values exceeded NPDES effluent limitations only at the Hastings Plant, resulting in six monthly permit violations.

Table 3-5 is a comprehensive summary of NPDES permit violations which occurred in 1982. Violations of weekly and monthly mass limitations on BOD and TSS, not shown in Table 3-3 are included in Table 3-5. Also shown are pH and fecal coliform violations. A total of 30 violations occurred in 1982, ranging from 18 at Hastings to none at Bayport, Blue Lake, Medina, Metropolitan, and Stillwater. A maximum of eight violations occurred in March, while no violations occurred in May or October.

The distribution of violations among effluent parameters and major problem areas are presented in Table 3-6. As shown in Table 3-6, 17 of 30 violations were caused by a plant operating at its capacity, 16 of which involved the Hastings Plant. Expansion of the Hastings Plant is planned to begin by late 1983.

Process Control problems during 1982, centered around: (1) ammonia loading from solids processing recycle streams at the Empire Plant and; (2) difficulty maintaining required close control of chlorination, resulting in violations of the fecal coliform standards at several plants.

The number of violations caused by industrial wastes decreased in 1982, as compared to 1981. This improvement was basically due to the absence of heavy metal and cyanide problems from the two major industries in Anoka. It should be noted, however, that industrial wastes have contributed to the problems at Hastings, even though the violations are all attributed to plant capacity in the aforementioned tabulation.

The number of effluent BOD violations decreased from 15 to 9 in 1982. This decrease approximately accounts for the decrease in total violations from 35 in 1981 to 30 in 1982. The change in number of effluent BOD violations did not occur because of process improvements alone. As previously mentioned, during 1982, effluent BOD violations were based on CBOD, rather than TBOD. During 1981, five of the 15 effluent BOD violations were attributed to nitrification in the BOD test.

TABLE 3-3

NPDES EFFLUENT LIMITATIONS - 1982

TREATMENT PLANT (a)	Standards Applicable	5-Day BOD mg/l 7-Day Avg.	5-Day BOD mg/l 30-Day Avg.	TSS, mg/l 7-Day Avg.	TSS, mg/l 30-Day Avg.	Fecal Coliform MPN/100 ml Geometric Mean(f) 7-Day Mean	Fecal Coliform MPN/100 ml Geometric Mean(f) 30-Day Mean	Turbidity NTU 7-Day Mean	Phosphorus mg/l 30-Day Mean	Ammonia mg/l 30-Day Mean	Dissolved Oxygen mg/l 30-Day Mean
ANOKA (b)	At All Times	45	25	45	30	400	200	25	---	---	---
BAYPORT	At All Times	45	25	45	30	400	200	25	1.0	---	---
BLUE LAKE	At All Times	45	25	45	30	400	200	25	---	---	---
CHASKA	At All Times	45	25	45	30	400	200	25	---	---	---
COTTAGE GROVE	At All Times	45	25	45	30	400	200	25	---	---	---
EMPIRE	At All Times	--	10	--	10	400	200	25	---	1.0	4.0
HASTINGS	At All Times	45	25	45	30	400	200	25	---	---	---
MAPLE PLAIN	At All Times	--	25	--	30	---	200	--	---	---	---
MEDINA(g)	At All Times	45	25	45	30	400	200	25	---	---	---
METROPOLITAN(c)	At All Times	44	24(d)	45	30	---	200	25	---	---	7.0(e)
ROSEMOUNT	At All Times	45	25	45	30	400	200	25	1.0	---	---
SAVAGE	At All Times	45	25	45	30	400	200	25	---	---	---
SENECA	At All Times	45	25	45	30	400	200	25	---	---	
STILLWATER	At All Times	45	25	45	30	400	200	25	1.0	---	---

(a) General Requirements for Essentially All Plants:
1) The pH shall not be less than 6.5 nor greater than 8.5. These upper and lower limitations are not subject to averaging and shall be met at all times.
2) There shall be no discharging of floating solids or visible foam in other than trace amounts.
3) The discharge shall not contain oil or other substances in amounts suficient to create a visible color or film.

(b) Additional 30-day mean permit standards for Anoka: chromium - 0.4 mg/l; copper - 0.3 mg/l lead - 0.5 mg/l; zinc - 0.5 mg/l; cyanide - 0.5 mg/l.

(c) Additional 30-day median permit standards for the Metropolitan Plant: copper - 0.14 mg/l; cadmium - 0..03 mg/l; mercury - 4.0 ug/l; cyanide - 0.193 mg/l.

(d) The Metropolitan Plant BOD and TSS limits were revised in the newly issued permit. The new permit limitations are retroactive to July 1, 1982.

(e) Dissolved oxygen limitation of 7 mg/L for river flows less than 7,000 cfs and river D.O. values less than 6.0 mg/l upstream or less than 5.5 mg/L downstream for two consecutive sample-days, during the period June through September.

(f) Disinfection required from March 1 through October 31 excpet for the Anoka Plant where disinfection is required year round.

(g) Medina Plant discharge from absorption ponds only - Must be authorized by MPCA.

TABLE 3-4

SUMMARY OF PLANT PERFORMANCE
1982

Treatment Plant	Permit Limitation		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Avg.
	Flow	2.46	2.11	2.15	2.30	2.25	2.34	2.27	2.12	2.07	2.04	2.02	2.05	1.98	2.14
	CBOD	25	13	10	10	12	10	11	12	9	10	13	18	12	12
Anoka	TSS	30	8	6	5	8	8	7	10	5	5	8	17	11	8
	Flow	0.65	0.48	0.48	0.47	0.65	0.55	0.56	0.52	0.52	0.48	0.52	0.53	0.54	0.52
	CBOD	25	12	11	9	9	5	6	6	6	5	5	9	9	8
Bayport	TSS	30	8	13	9	10	5	5	5	6	9	8	11	10	8
	Flow	20.0	14.3	14.7	17.5	18.2	17.6	15.8	14.9	15.6	15.8	16.0	16.7	16.1	16.1
	CBOD	25	14	16	9	11	12	6	8	9	8	9	12	12	10
Blue Lake	TSS	30	6	8	6	10	8	4	6	5	8	7	6	5	7
	Flow	1.40	0.70	0.64	0.99	1.06	0.90	0.76	0.71	0.71	0.75	0.74	0.84	0.77	0.80
	CBOD	25	15	19	14	14	13	12	12	13	21	8	14	11	14
Chaska	TSS	30	13	16	11	7	9	10	8	9	8	11	15	14	11
	Flow	1.80	1.22	1.29	1.30	1.22	1.27	1.26	1.19	1.21	1.28	1.24	1.27	1.32	1.26
	CBOD	25	18	13	11	12	15	8	8	6	4	5	8	13	10
Cottage Grove	TSS	30	9	10	9	10	7	8	3	6	4	5	6	12	7
	Flow	6.00	3.31	3.40	3.74	4.89	4.77	4.56	3.87	4.05	4.10	4.08	4.12	3.72	4.05
	CBOD	10	4*	3*	2	2	2	3	3	3	2	2	2	2	2
Empire	TSS	10	1	1	2	2	1	2	1	1	1	1	1	1	1
	Flow	1.83	1.55	1.42	1.57	1.52	1.63	1.60	1.44	1.52	1.51	1.37	1.43	1.47	1.50
	CBOD	25	31	31	34	24	14	12	22	12	8	9	22	23	20
Hastings	TSS	30	36	39	50	37	28	25	19	25	18	22	35	40	31
	Flow	0.22	0.20	0.24	0.47	0.59	0.58	0.32	0.26	0.24	0.27	0.29	0.41	0.37	0.35
	CBOD	25	28	9	18	27	15	16	10	13	8	4	8	7	13
Maple Plain	TSS	30	8	2	10	8	13	14	5	10	3	3	5	6	7
	Flow	0.10	0.095	0.115	0.173	0.228	0.255	0.212	0.150	0.111	0.117	0.116	0.106	0.113	0.149
	Discharge	NO	YES	NO	YES	YES	YES	NO	NO	NO	NO	NO	YES	NO	---
	CBOD	25	17	11	16	19	16	13	14	20	8	8	16	15	14
Medina	TSS	30	19	12	11	19	20	16	16	10	2	19	13	13	14
	Flow	220	179	185	215	236	239	214	212	230	230	194	182	177	208
	CBOD	24	14	19	21	10	10	18	11	8	11	11	11	11	13
Metropolitan	TSS	30	7	19	27	7	8	17	10	4	11	8	8	8	11
	Flow	0.60	0.28	0.31	0.40	0.32	0.29	0.29	0.29	0.31	0.32	0.31	0.32	0.32	0.31
	CBOD	25	18	16	12	19	15	15	14	16	21	20	14	12	16
Rosemount	TSS	30	3	2	1	2	2	2	3	2	2	2	2	2	2
	Flow	0.86	0.41	0.42	0.56	0.62	0.58	0.44	0.42	0.47	0.45	0.44	0.49	0.49	0.48
	CBOD	25	14	6	6	8	7	7	7	8	5	14	16	6	8
Savage	TSS	30	5	2	3	2	3	11	10	3	2	2	7	1	4
	Flow	24.0	14.0	14.7	15.6	15.6	15.5	14.6	14.8	11.5	14.6	14.7	15.6	15.9	14.7
	CBOD	25	18	16	21	25	19	17	19	15	13	16	19	20	18
Seneca	TSS	30	19	17	18	21	13	16	24	22	20	21	23	19	19
	Flow	3.02	2.26	2.29	2.44	3.16	2.98	2.71	2.51	2.46	2.43	2.68	2.64	2.78	2.61
	CBOD	25	9	8	11	12	11	9	13	9	7	8	10	10	10
Stillwater	TSS	30	6	7	7	7	10	7	9	9	8	14	10	10	8

*Values represent TBOD

TABLE 3-5

SUMMARY OF NPDES PERMIT NON-COMPLIANCE IN 1982

TREATMENT PLANT	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL BY: NUMBER	TOTAL BY: MONTH
ANOKA			WFC								WFC		2	2
BAYPORT													0	0
BLUE LAKE													0	0
CHASKA									WB				1	1
COTTAGE GROVE						WFC							1	1
EMPIRE	MAm	MAm		MAm									3	3
HASTINGS	MB, MS WS	MB, MS	MB, WB MS, WS $\overline{MB}$, $\overline{MS}$				WFC	WFC			MS	MS, WS	18	8
MAPLE PLAIN	MB			MB									2	2
MEDINA													0	0
METROPOLITAN													0	0
ROSEMOUNT									pH				1	1
SAVAGE											WB		1	1
SENECA			pH										1	1
STILLWATER													0	0
TOTALS	3	2	3	3	0	1	1	1	2	0	3	1	30	20

Symbols: MB,WB= Monthly and Weekly BOD Conc; MS,WS= Monthly and Weekly TSS Conc; $\overline{MB}$,$\overline{WB}$,$\overline{MS}$,$\overline{WS}$= Mass Limits; MFC,WFC= Monthly and Weekly Fecal Coliform; pH; MP= Monthly Phosphorus Conc; $\overline{MP}$= Mass Limit; T-Turbidity; MAm= Monthly NH_3-N; MDO= Monthly Dissolved Oxygen; MCN,DCN= Monthly and Daily Cyanide; MCu,DCu= Monthly and Daily Copper; MCr,DCr= Monthly and Daily Chromium; MPb= Monthly and Daily Lead; MZn,DZn= Monthly and Daily Zinc.

TABLE 3-6

NPDES PERMIT VIOLATION DISTRIBUTION
1982

Distribution of Violations Among Effluent Parameters

PARAMETER	NUMBER OF VIOLATIONS 1ST QUARTER	2ND QUARTER	3RD QUARTER	4TH QUARTER	TOTAL
BOD	6	1	1	1	9
TSS	6	2	0	3	11
FECAL COLIFORM	1	1	2	1	5
pH	1	0	1	0	2
AMMONIA	2	1	0	0	3
	16	5	4	5	30

Distribution of Violations Among Problem Areas

PROBLEM AREA	NUMBER OF VIOLATIONS 1ST QUARTER	2ND QUARTER	3RD QUARTER	4TH QUARTER	TOTAL
PROCESS CONTROL	3	2	2	1	8
INDUSTRIAL WASTES	1	0	1	1	3
PLANT CAPACITY	11	3	0	3	17
EQUIPMENT FAILURE	1	0	1	0	2
	16	5	4	5	30

Accounting for this change in analytical procedure, overall plant performance during 1981 and 1982 was essentially unchanged. However, an analysis of individual plants indicates that only Hastings had increased violations, whereas most plants improved their performance or maintained a continued record of excellence.

The following is a plant-by-plant summary of non-compliance problems during 1982.

Anoka: The Anoka Plant had two weekly fecal coliform violations. One violation was the result of chlorination equipment problems. The other violation resulted from experimentation with chlorine feed rates, aimed at reducing effluent chlorine residual. The experimentation took place after the chlorine contact tank had been modified to eliminate short-circuiting problems. Chlorine mixing improvements will be made in 1983, in an attempt to reduce effluent chlorine residual.

Chaska: The Chaska Plant had one weekly BOD violation. The plant was organically overloaded for a short period, as a result of an industrial waste discharge. This problem is being resolved through the industrial pretreatment program.

Cottage Grove: The Cottage Grove Plant had one weekly fecal coliform violation resulting from partial nitrification in the activated sludge process. This reduced the disinfection efficiency of the chlorination process.

Empire: The Empire Plant had three monthly ammonia violations, resulting from process control problems related to the solids processing facilities, i.e. recycle loads from digestion and dewatering.

Hastings: The Hastings Plant had 16 BOD and TSS violations, which were primarily caused by operation at or above effective plant capacity. In addition, there were industrial waste problems. The plant had two weekly fecal coliform violations, due to partial nitrification in the activated sludge process which reduced the disinfection efficiency of the chlorination process.

Maple Plain: The Maple Plain Plant had two monthly BOD violations. One violation resulted from aeration equipment problems and the other violation was caused by flows well above plant capacity.

Rosemount: The Rosemount Plant had one daily pH violation, which was caused by an acid spill within the plant that resulted in some acid passing through the treatment process.

Savage: The Savage Plant had one weekly BOD violation, which was caused by a high pH waste discharge from a local industry, resulting in a biological treatment process upset at the plant.

Seneca: The Seneca Plant had one daily pH violation, for which there was no apparent cause.

The following comments of 1982 treatment plant performance are also significant:

1. The Metropolitan Plant performance has met secondary treatment limitations during the past three years. Effluent quality during 1982 was consistently below the secondary treatment limitations of 25 mg/L BOD and 30 mg/L TSS.

2. The Metropolitan Plant had no significant bypasses during 1982. Only 0.04% of the untreated wastewater was bypassed. Improved effluent quality has been achieved despite the burden posed by the larger volume of combined sewage treated. This has been made possible by the near completion of the plant expansion program, which has effectively reduced the volume of combined sewer overflows to the Mississippi River by about half.

3. In addition to the Metropolitan Plant, plant performance in 1982 improved at Anoka, Chaska, Maple Plain, and Stillwater. Only Hastings experienced poorer performance during 1982 and this is attributable to plant capacity limitations.

4. Nearly all of the treatment plants are performing as well as can be expected for the type of facilities available. Plant performance can be expected to stabilize during 1983 and beyond. Performance at some plants may deteriorate as plant capacity is approached or exceeded, or as equipment reaches the end of its useful life and becomes subject to more frequent downtime.

3.4 Program Goals

Initially developed in 1976, the Commission continues to utilize a criteria which rapidly assesses plant performance. The assessment is made in terms of four parameters: Compliance (C), Frequency (F), Severity (S), and Noncompliance Index (NCI).

Compliance (C) is the percentage compliance with NPDES effluent limitations as listed in each plant's NPDES Permit. The nearer the compliance number is to 100 percent, the better the plant performance.

Frequency (F) is the frequency of compliance with NPDES effluent limitations. It is calculated by dividing the total number of BOD and TSS analyses complying with effluent standards by the total number of BOD and TSS analyses performed and expressing the result as a percentage. The nearer the frequency number is to 100 percent, the better the plant performance as related to effluent quality standards.

Severity (S) is the deviation from the standard for those BOD and TSS analyses which exceed NPDES effluent limitations. It is determined by locating the median value of those values exceeding the standards and expressing the deviation as a percentage of the NPDES limit. The larger the severity number, the greater the magnitude of violation of effluent standards.

In judging the performance of plants, both frequency and severity must be considered; therefore, noncompliance index was developed to allow a rapid, single-number assessment of plant performance. The noncompliance index (NCI) is determined by multiplying the percent severity by the noncompliance (100-frequency) and dividing by 100. A low noncompliance index indicates better overall compliance with effluent quality standards.

Performance objectives in terms of compliance, frequency, and severity are defined in the operating budget of each individual treatment plant. In addition, Administration and Management (Program 001-Chief Administrator) has goals for compliance and severity at the Metropolitan Plant, and at all other plants combined. Operations Administration (Program 029-Director of Operations) has goals for compliance, frequency, and severity, related to the Metropolitan Plant, and to all other plants combined. Process Assurance (Program 030-Process Assurance Manager) has a goal based on compliance.

A summary of 1982 goals and actual performance at each plant is provided in Table 3-7. During 1982, thirteen plants met their compliance goals, thirteen plants met their frequency goals, eight plants met their severity goals, and thirteen plants met their noncompliance index goals. Individual plant goal attainment is summarized as follows:

All Goals	Three Goals	No Goals
Anoka	Cottage Grove (C, F, NCI)*	Hastings
Bayport**	Empire (C, F, NCI)*	
Blue Lake**	Rosemount (C, F, NCI)*	
Chaska	Savage (C, F, NCI)*	
Maple Plain		
Medina		
Metropolitan		
Seneca		

* Letter in parentheses indicates goal(s) met.
**These plants have a perfect record of 100% compliance, 100% frequency, and no severity.

The causes of the non-achievement of goals are as follows:

1. Cottage Grove (S) - Severity is above the goal level, because one reported BOD value in May was quite high. Based on other data collected at that time, this value appears to be unrepresentative of actual conditions, perhaps due to sampling problems.

2. Empire (S) - The severity is above the goal because a filter bypass on June 22 resulted in one high TSS value.

3. Hastings (C, F, S) - Performance was poor during 1982, because the plant was operated at plant capacity, in conjunction with activated sludge toxicity problems related to industrial wastes.

4. Rosemount (S) - Severity is above the goal level, due to several high effluent BOD values related to carbon column regeneration schedules.

5. Savage (S) - Severity is above the goal level, because there was one very high BOD value in November, due to an industrial waste shock loading that upset the biological treatment system.

6. Stillwater (S) - Severity is above the goal because a major rainfall event in July necessitated bypassing of the plant flow around the activated sludge process causing higher effluent BOD and TSS for that day.

A summary of 1982 goals and performance for other administrative programs is provided in Table 3-8. All goals were met during 1982.

TABLE 3-7

SUMMARY OF TREATMENT PLANT GOAL PARAMETERS
Compliance, Frequency, Severity, and Noncompliance Index Values for 1982 Compared to 1982 Goals and 1981, 1980 Actual Goals

	Compliance				Frequency				Severity				Noncompliance Index			
Treatment Plant	Actual 1980	Actual 1981	Actual 1982	Goal 1982	Actual 1980	Actual 1981	Actual 1982	Goal 1982	Actual 1980	Actual 1981	Actual 1982	Goal 1982	Actual 1980	Actual 1981	Actual 1982	Goal 1982
Anoka	97	97	99	98	97	94	98	93	10	16	4	33	0.3	1.0	0.1	2.3
Bayport	100	100	100	98	99	100	100	93	13	0	0	33	0.1	0.0	0.0	2.3
Blue Lake	100	100	100	99	99	97	100	95	36	40	0	33	0.4	1.2	0.0	1.6
Chaska	96	98	99	98	90	89	96	93	52	32	24	33	5.2	3.5	0.9	2.3
Cottage Grove	99	96	99	97	99	97	99	93	75	32	36	33	0.8	1.0	0.4	2.3
Empire	99	100	98	97	99	99	99	95	30	30	80	25	0.3	0.3	0.3	1.2
Hastings	97	94	87	95	79	80	64	80	24	24	37	33	5.0	4.8	13.1	6.6
Maple Plain	95	99	96	92	80	94	93	85	20	37	12	45	4.0	2.2	0.8	6.8
Medina	100	83	100	100	72	74	90	70	20	60	32	50	5.6	15.6	3.3	15.0
Metropolitan	96	89	100	97	81	81	93	90	40	40	36	40	7.6	7.6	2.5	4.0
Rosemount	99	100	99	98	98	97	97	95	56	48	36	25	1.1	1.4	1.0	1.2
Savage	100	100	99	98	99	98	97	93	13	36	43	33	0.1	0.7	1.1	2.3
Seneca	100	99	90	97	95	91	94	93	16	27	16	33	0.8	2.4	0.9	2.3
Stillwater	99	99	100	98	96	90	99	95	42	32	37	33	1.7	3.2	0.2	1.6

TABLE 3-8

SUMMARY OF ADMINISTRATIVE GOAL ATTAINMENT

Administration and Management (001) Goal Attainment

Plant(s)	NPDES Compliance, %		Severity, %	
	Goal	Actual	Goal	Actual
METROPOLITAN	97	100	40	36
ALL OTHERS	96	98	34	28

Operations Administration (029) Goal Attainment

Plant(s)	NPDES Compliance, %		Frequency, %		Severity, %	
	Goal	Actual	Goal	Actual	Goal	Actual
METROPOLITAN	97	100	90	93	40	36
ALL OTHERS	96	98	90	94	34	28

Process Assurance (030) Goal Attainment

Plant(s)	NPDES Compliance, %	
	Goal	Actual
ALL	97	98

4.0 INCINERATOR EMISSION QUALITY

Sludge generated at Commission Treatment Plants is disposed of by either digestion, landspreading, or incineration. Much of the sludge generated at the Metropolitan and Seneca Treatment Plants is incinerated, with the ash landfilled. When incineration is used as a sludge disposal method, emissions from the incineration process are subject to limitations. The purpose of these limitations is to prevent deterioration of existing ambient air quality. Incinerator emission limitations or standards are contained in MPCA's Air Quality Rules and Regulations.

4.1 Emission Standards

APC-9 of MPCA's Air Quality Rules and Regulations deals with the control of odors by limiting odor emission rates from defined odor sources and by establishing odor standards for ambient air based upon local zoning.

Odor standards are expressed as odor concentration units. The odor concentration unit is defined as the number of standard cubic feet of odor free air needed to dilute each cubic foot of contaminated air to a point where at least 50 percent of the individuals comprising the odor test panel do not detect an odor in the diluted mixture.

An odor source as defined in APC-9 includes, but is not limited to, any stack, chimney, vent, window, opening, lagoon, basin, pond, open tank, or any organic or inorganic discharge and or application which emits odorous gas, gases, or particulates.

The odor emission rate is the product of the number of standard cubic feet per minute of air or other gases emitted from a suspected odor pollution source and the number of odor concentration units determined for that source.

The following odor limitations are contained in APC-9:

1. Sources emitting odors from well defined stacks, 50 feet or more above grade elevation, and with adequate dispersion characteristics, as determined by the Agency, shall not emit odors greater than 150 odor concentration units.

2. Sources emitting odors of less than 50 feet elevation above grade or otherwise failing to create good dispersion conditions, as determined by the Agency, shall not emit more than 25 odor concentration units.

3. No odor source shall have an odor emission rate in excess of 1,000,000 odor concentration units per minute.

APC 28 of MPCA's Air Quality Rules and Regulations sets standards for particulate matter and opacity. These standards apply to emissions from both new and existing sewage sludge incinerators. Incinerators operating at the Metropolitan and Seneca Plants, during 1982, fall into the existing sludge incinerator category. Portions of APC 28, dealing with existing sewage sludge incinerators, state that no owner or operator of an existing sewage sludge incinerator shall cause to be discharged into the atmosphere from the sewage sludge incinerator any gases which exhibit greater than 20 percent opacity and which contain particulate matter in excess of the concentrations shown in Table 4-1.

TABLE 4-1

EMISSION STANDARDS FOR EXISTING SEWAGE SLUDGE INCINERATOR, APC-28

Incinerator Burning Capacity (lb/hour)	Particulate Emission Standard grain/dscf corrected to 12% CO2	Percent Opacity	
		Average	Maximum*
200	0.3	20	40
200-2000	0.2	20	40
>2000	0.1	20	40

*A maximum of 40 percent opacity is permissible for four minutes in any 60 minute period.

Burning capacity is defined as the manufacturer's or designer's maximum rate, or such other rate that is considered good engineering practice.

APC 31 of MPCA's Air Quality Rules and Regulations sets standards for mercury emissions. This regulation states that no owner or operator of a sludge incineration and drying plant shall cause to be discharged into the atmosphere from such plant more than 3,200 grams of mercury per 24 hour period.

During the latter part of 1981, permits were issued by MPCA to the Commission for the operation of sludge incinerators at the Metropolitan and Seneca Plants. In September, 1982, installation of a scrubber system was completed on the Scum Incinerator at the Metropolitan Plant.

Emission limitations contained in operating permits and state air quality regulations are summarized in Table 4-2. Presently, standards listed in Table 4-2 apply to Incinerators 1-4 in Filtration and Incineration Building No. 1, and the Scum Incinerator at the Metropolitan Plant and Incinerators 1 and 2 in the Solids Processing Building at the Seneca Plant.

TABLE 4-2

SUMMARY OF EXISTING INCINERATOR EMISSION STANDARDS FOR THE METROPOLITAN AND SENECA PLANTS

Parameter	Metropolitan Plant F & I No. 1	Metropolitan Plant Scum Incinerator**	Seneca Plant
Particulate Matter, grain/dscf at 12% CO2	0.1	0.2	0.2
Opacity, percent	20/40*	20/40*	20/40*
Gas Odor Content, Odor Concentration Units	25	25	150
Odor Emission rate, odor concentration units/min.	1×10^6	1×10^6	1×10^6
Mercury emission rate, grams/24 hour	3200	----	3200

* Average opacity standard is 20 percent; except that a maximum of 40 percent opacity is permissible for four minutes in any 60 minute period.

**Emissions from the Scum Incinerator are derived from APC-7 of MPCA's Air Quality Rules and Regulations which deals with refuse incineration.

4.2 Summary of 1982 Air Emissions

During 1982, stack gases from incinerators at the Metropolitan and Seneca Plants were sampled and analyzed for particulate matter, opacity, odors, and mercury. Tables 4-3 and 4-4 present summaries of 1982 opacity test results for Filtration and Incineration Building No. 1 and the Scum Incinerator at the Metropolitan Plant, and the Seneca Plant Solids Processing Building. Figure 4-1 illustrates that the percentage of opacity tests meeting standards, for Filtration and Incineration Building No. 1 at the Metropolitan Plant, has increased to 92 percent in 1982 and that the percentage of opacity tests meeting standards, for the Solids Processing Building at the Seneca Plant, has increased from approximately 40 percent in 1978 to 76 percent in 1982. The percentage of opacity tests meeting standards for the Scum Incinerator at the Metropolitan plant was 60 percent during 1982. Opacity failures of the Scum Incinerator are due to the operation of the incinerator/scrubber equipment in various experimental modes during 1982.

Table 4-5 summarizes results of particulate testing conducted at the Metropolitan and Seneca Plants during 1982. Annual average particulate emission from the Filtration and Incineration Building No. 1 at the Metropolitan Plant was 0.074 g/dscf. Annual average particulate emission from the Scum Incinerator at the Metropolitan Plant was 0.237 g/dscf. Annual average particulate emission at the Seneca Plant was 0.200 g/dscf.

Tests results from odor monitoring of incinerator stack discharge at the Seneca Plant are presented in Table 4-6 and show that the Seneca Plant was in compliance with MPCA standards while the Metropolitan Plant failed to meet MPCA odor emission standards.

Mercury emission testing conducted during 1982 show that both the Metropolitan and Seneca Plants met standards set forth in APC 31. Annual average mercury emissions were 137 gm/24 hr. at the Seneca Plant and 452 gm/24 hr. at the Metropolitan Plant.

Incinerators in Filtration and Incineration Building No. 2 at the Metropolitan Plant remained inactive during 1982 as incinerator and scrubber renovation continued. Incinerators in Filtration and Incineration Building No. 1 at the Metropolitan Plant were shutdown in late September of 1982 and all sludge generated at the Metropolitan Plant was disposed of by land application or composting.

TABLE 4-3

SUMMARY OF OPACITY MEASUREMENTS
METROPOLITAN PLANT
FILTRATION AND INCINERATION BUILDING NO. 1 AND SCUM INCINERATOR BUILDING
1982

		Percent Opacity					
		Stack No.				Gravity Stack	Scum Inc.
Month	Date	1	2	3	4	(Srubber ByPass)	Building
January	5	18a	6	*	*	*	*
	12	9	14	*	*	*	*
	20	14a	6	*	*	*	*
	28	8	*	10	*	*	*
February	1	*	*	*	*	53	*
	2	*	6	*	5	*	*
	4	*	*	13	*	*	*
	11	5	*	*	8	*	*
	12	*	*	6	*	*	*
	16	5	*	6	8	*	*
	26	5	*	6	*	*	*
March	2	*	*	7	*	*	*
	19	*	20a	*	*	*	*
	29	*	*	*	*	48	*
	30	7	*	*	6	*	*
April	19	6	7	*	6	*	*
	26	*	6	*	7	*	*
	27	5	*	*	*	*	*
May	4	7	10	*	*	*	*
	6	*	*	*	*	*	18a
	10	5	6	*	*	*	*
	14	*	*	*	6	*	*
	20	10	9	*	6	*	*
	21	*	*	*	*	*	*
	24	*	10	*	*	*	*
June	9	8	*	*	*	*	*
	14	5	*	*	*	*	*
	17	4	*	*	5	*	*
	25	*	*	*	*	*	*
	28	0	*	*	3	*	*
July	6	0	*	*	1	*	*
	15	6	7	*	*	*	*
	22	6	5	*	6	*	*
	30	2	1	*	*	*	*
August	2	*	*	*	6	*	*
	4	*	*	*	*	29	*
	6	6	0	*	*	*	44
	10	1	0	*	*	*	*
	11	*	*	*	5	*	*
	16	0	0	*	5	*	*
	23	2	*	*	*	*	*
	24	*	*	*	7	*	*
	26	*	5	*	*	*	*
September	3	3	*	*	8	*	*
	8	3	1	*	*	*	*
	10	*	*	*	6	*	*
	13	7	4	*	*	*	*
	29	*	*	*	*	*	10
October	Incinerators Shut Down						*
							*
November	Incinerators Shut Down						*
							*
December	6						6
	21						7
Total Test Measurements		28	20	6	18	3	5
Number of Tests Passing Std.		26	19	6	18	0	3
Number of Tests Failing Std.		2	1	0	0	3	2
Percent of Tests Passing Std.		93	95	100	100	0	60

(a)Exceed 40 percent opacity longer than 4 minutes in 60 minute period - Fails to meet APC 28 Limits.

TABLE 4-4

SUMMARY OF OPACITY MEASUREMENTS
SENECA PLANT
1982

Month	Date	Percent Opacity
January	11	5
	19	8
	28	17a
February	1	14
	16	11
March	3	19
	9	6
	19	21
	22	15a
	31	35
April	7	8
	15	18
	23	57
	27	5
May	4	7
	10	16
	17	25
June	1	6
	9	18
	18	7
	22	6
	30	8
July	6	13
	20	7
	26	8
August	2	6
	13	29
	17	23
September	3	5
	14	8
	20	5
October	4	3
	13	11
	18	7
November	*	*
December	*	*
Total Test Measurements		34
Number of Tests Passing Std.		26
Number of Tests Failing Std.		8
Percent of Tests Passing Std.		76

(a)Exceed 40 percent opacity longer than 4 minutes in 60 minute period - Fails to meet APC 28 Limits.

FIGURE 4-1

SUMMARY OF OPACITY TESTING

METROPOLITAN PLANT F & I NO. 1 BUILDING
SENECA PLANT SOLIDS PROCESSING BUILDING
1978-1982

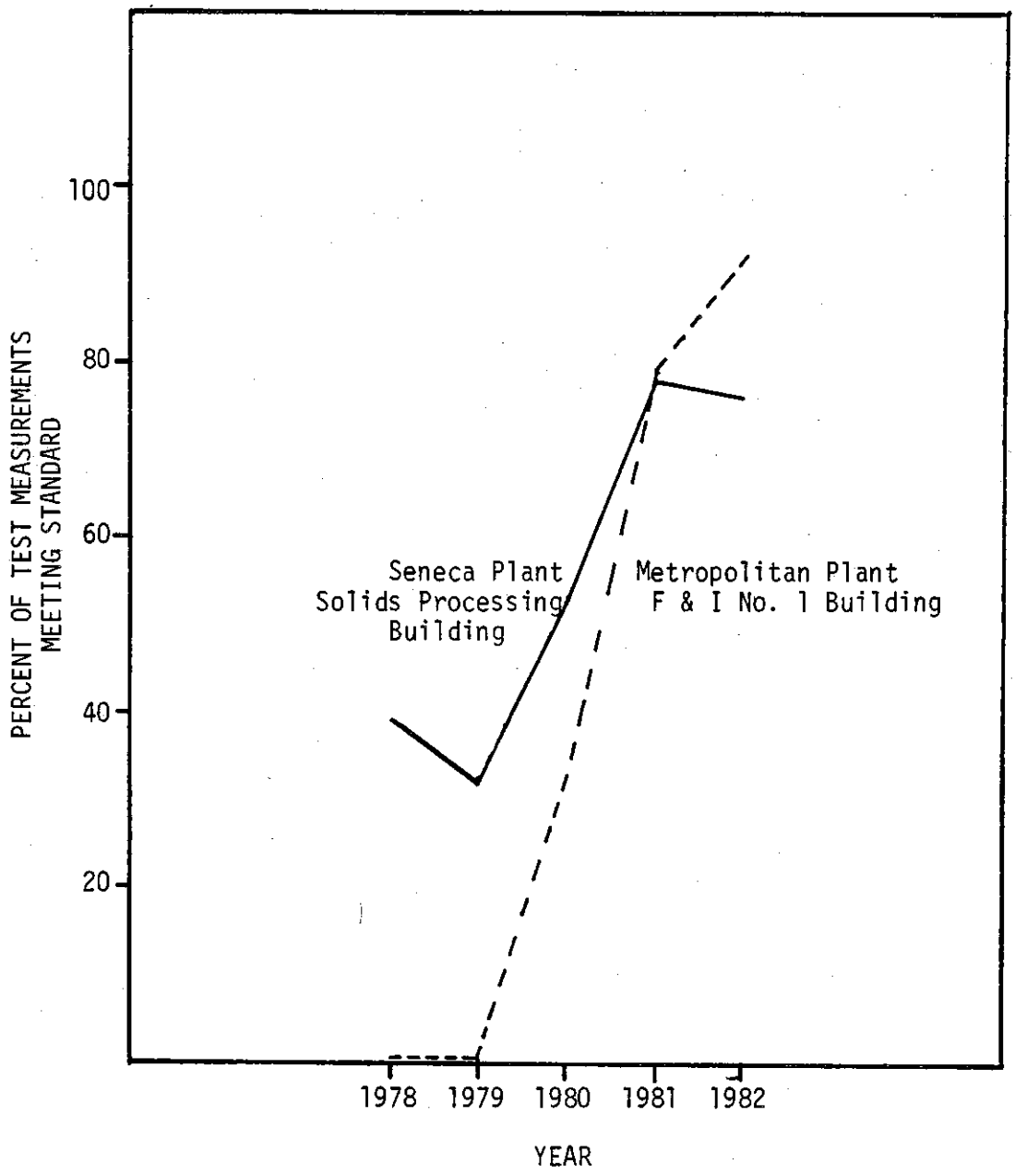


TABLE 4-5

SUMMARY OF 1982 PARTICULATE TESTING
METROPOLITAN AND SENECA PLANTS

A. Metropolitan Plant, Filtration and Incineration Building No. 1

Date	Stack ID	Burning Rate % of Design Capacity	Stack Gas Flow Rate, SCFM	Particulate grains/dscf at 12% CO2
2/18	4-3	85	13,646	.0909**
4/6	4-1	91	12,934	.0749**
4/30	4-4	87	11,919	.1210*
5/11	4-2	83	14,529	.0716**
5/18	4-1	81	12,667	.0440**
7/7	4-4	75	14,204	.0424*
	Average	84	13,316	.0741

B. Metropolitan Plant, Scum Incinerator

Date	Stack ID	Burning Rate % of Design Capacity	Stack Gas Flow Rate, SCFM	Particulate grains/dscf at 12% CO2
10/19	Scrubber Stack	67	5,160	.3283*
10/26	Scrubber Stack	55	2,914	.3305*
11/5	Scrubber Stack	48	3,603	.2295*
11/18	Scrubber Stack	48	3,118	.2282*
11/24	Scrubber Stack	48	3,010	.2295*
12/1	Scrubber Stack	49	2,321	.1766*
12/6	Scrubber Stack	48	2,843	.2073*
12/15	Scrubber Stack	40	2,662	.1802*
12/21	Scrubber Stack	43	2,990	.2300**
	Average	50	3,180	.2377

C. Seneca Plant, Solids Processing Building

Date	Stack ID	Burning Rate % of Design Capacity	Stack Gas Flow Rate, SCFM	Particulate grains/dscf at 12% CO2
3/11	Common	64	21,980	.1535*
3/25	Common	79	21,769	.1981**
5/28	Common	109	18,306	.2452**
6/11	Common	59	12,977	.3332**
6/23	Common	57	13,310	.1874**
6/29	Common	55	12,061	.1366**
10/7	Common	53	11,003	.1493*
	Average	68	15,915	.2005

* Calculated using CO2 produced by sludge only.

**Calculated using CO2 produced by sludge and fuel oil.

TABLE 4-6

ODOR MONITORING RESULTS OF INCINERATOR STACK DISCHARGE
1982

Plant	Date	Stack ID	Stack Gas Odor[1] Concentration, O.U.	Stack Odor Emission[2] Rate, O.U./Min.
Seneca	8/5/82	Common	34	1,000,000
Metropolitan F & I No. 1	7/27	4-1	107	2,000,000
	7/27	4-2	111	2,100,000
	7/27	4-4	127	2,300,000

(1) MPCA Standard for Seneca Plant = 150 O.U.
MPCA Standard for Metropolitan Plant = 25 O.U.

(2) MPCA Standard for stack odor emission rate at Seneca and Metropolitan Plants is 1,000,000 O.U./Min.

5.0 SLUDGE MANAGEMENT

Each of the Commission's treatment plants produces sludge as a result of wastewater treatment. At Medina, sludge settles in treatment ponds, and although periodic removal will ultimately be required, formal treatment is not provided. At all other plants, sludge treatment may include thickening, digestion, chemical conditioning, and dewatering. Final disposal of sludge is accomplished either by landspreading or incineration.

5.1 Sludge Processing

Table 5-1 is a summary of sludge processing and disposal methods utilized at Commission Plants. As shown in Table 5-1, most plants provide some form of sludge thickening, either in primary tanks or in independent thickener units. At the Metropolitan and Seneca Plants, gravity thickening is provided for primary sludge, while air flotation thickening is provided for secondary or waste activated sludge. At the Empire and Cottage Grove Plants, gravity thickening is provided for combined sludge.

Most of the smaller outlying plants provide sludge digestion to reduce and stabilize sludge solids. One exception is the Rosemount Plant, where chemical sludge produced by physical-chemical treatment of wastewater, is concentrated and transported to the Metropolitan Plant for disposal.

5.2 Sludge Disposal

During 1982, 104,716 dry tons of sludge were processed at Commission plants. A summary of sludge quantities processed at each of the Commission plants is shown in Table 5-2.

Sludge disposal methods presently utilized by the Commission include: (1) transporting of sludge to the Blue Lake, Seneca, or Metropolitan Plants for further processing; (2) landspreading; and (3) incineration.

Digested sludge from the Chaska Plant is transported to the Blue Lake Plant. Sludge from the Blue Lake Plant is transported by tanker truck to either the Seneca or Metropolitan Plant. Digested sludges from the Anoka, Bayport, Cottage Grove, Hastings, Maple Plain, and Stillwater Plants and undigested sludge from the Rosemount Plant are transported through the interceptors to the Metropolitan Plant for further processing. Digested sludge from the Hastings, Cottage Grove, Stillwater, Maple Plain and Savage Plants is also landspread. Table 5-3 lists the annual quantities of sludge transported from each of the outlying plants, the interim disposal location, and the final disposal location.

TABLE 5-1

SUMMARY OF SLUDGE PROCESSING
1982

TREATMENT PLANT	THICKENING	DIGESTION	CONDITIONING	DEWATERING	SLUDGE DISPOSAL METHOD
Anoka	In Primaries	Anaerobic	None	None	(1)
Bayport	None	Aerobic	None	None	(1)
Blue Lake	In Primaries	None	None	None	(1) (2)
Chaska	None	Aerobic	None	None	(3)
Cottage Grove	Gravity	Anaerobic	None	None	(1) (4)
Empire	Gravity	Anaerobic	Polymer	Centrifuging	(4)
Hastings	In Primaries	Anaerobic	None	None	(1) (4)
Maple Plain	In Primaries	Anaerobic	None	None	(1) (4)
Medina	None	None	None	None	-------
Metropolitan	Gravity (Primary)	None	Chemical	Vacuum Filters/Roll Presses	(4) (5)
	Air Flotation (Secondary)	None	Chemical	Vacuum Filters	(4) (5)
			Thermal	Plate & Frame Presses	(4) (5)
Rosemount	In Holding Tank	None	None	None	(1)
Savage	In Holding Tank	Anaerobic	None	None	(2) (4)
Seneca	Air Flotation (Secondary)	None	Chemical	Vacuum Filters	(5)
Stillwater	In Primaries	Anaerobic	None	None	(1) (4)

SLUDGE DISPOSAL METHODS:

(1) Transported to Metropolitan Plant for further processing

(2) Transported to Seneca Plant for further processing

(3) Transported to Blue Lake Plant for further processing

(4) Landspreading

(5) Incineration

TABLE 5-2

SUMMARY OF SLUDGE PRODUCTION AND DISPOSAL METHODS
1982

Treatment Plant	Annual Sludge Production MG	Annual Sludge Production Dry Tons	Sludge Disposal Method
Anoka	3.99	295	(1)
Bayport	1.24	112	(1)
Blue Lake	37.12	7,594	(1) (2)
Chaska	2.64	175	(3)
Cottage Grove	3.48	234	(1) (4)
Empire	-----	544	(4)
Hastings	2.76	350	(1) (4)
Maple Plain	0.06	15	(1) (4)
Medina	-----	----	-------
Metropolitan			
a) Filtration and Incineration Bldg. 1, Vacuum Filters	-----	28,359	(4) (5)
b) Filtration and Incineration Bldg. 2, Vaccum Filters	-----	33,006	(4) (5)
c) Filter Presses	-----	14,862	(4) (5)
d) Roll Presses	-----	5,540	(4) (5)
Rosemount	1.45	618	(1)
Savage	0.25	47	(2) (4)
Seneca	-----	12,402	(5)
Stillwater	5.05	563	(1) (4)

(1) Transported to Metropolitan for further processing.
(2) Transported to Seneca Plant for further processing.
(3) Transported to Blue Lake Plant for further processing.
(4) Landspreading
(5) Incineration

NOTE: Annual sludge production includes sludge transported from other plants for further processing and chemicals added for sludge conditioning where applicable.

TABLE 5-3

SUMMARY OF 1982 SLUDGE HAULING

Treatment Plant	Interim Disposal Location	Final Disposal Location	Amount Hauled During 1982 (MG)
Anoka	Coon Rapids Interceptor	Metropolitan Plant	3.99
Bayport	Oakdale Interceptor	Metropolitan Plant	1.24
Blue Lake	Seneca Plant	Seneca Plant	12.21
	3rd and Commercial Interceptor	Metropolitan Plant	24.92
Chaska	Blue Lake Plant	Seneca Plant Metropolitan Plant	2.64
Cottage Grove	U of M Experimental Ag. Station	Landspread	0.51
	Oakdale Interceptor	Metropolitan Plant	0.22
	Farm Land	Landspread	0.48
	Sludge Drying Beds	Landspread	0.15
	So. St. Paul Interceptor	Metropolitan Plant	2.11
Hastings	U of M Experimental Ag. Station	Landspread	0.37
	Farm Land	Landspread	1.17
	Oakdale Interceptor	Metropolitan Plant	0.02
	3rd and Commercial Interceptor	Metropolitan Plant	0.07
	South St. Paul Interceptor	Metropolitan Plant	1.12
Maple Plain	Sludge Drying Beds	Landspread	0.008
	Orono Interceptor	Blue Lake/Metropolitan	0.020
	Plymouth Interceptor	Blue Lake/Metropolitan	0.032
Rosemount	3rd and Commerical Interceptor	Metropolitan Plant	1.45
Savage	Farm Land	Landspread	0.15
	Sludge Drying Beds	Landspread	0.04
	Seneca Plant	Seneca Plant	0.04
	3rd and Commercial Interceptor	Metropolitan Plant	0.02
Stillwater	Oakdale Interceptor	Metropolitan Plant	4.67
	Farm Land	Landspreading	0.38

At the Empire, Metropolitan, and Seneca Plants, sludge conditioning and dewatering are provided. At the Empire Plant, dewatered sludge is landspread; at the Metropolitan Plant dewatered sludge is either incinerated or landspread; at the Seneca Plant, dewatered sludge is incinerated.

5.3 Sludge Quality

During 1982, digested sludge from the outlying plants and dewatered sludge or sludge cake from the Metropolitan and Seneca Plants were analyzed routinely for solids, nutrients, and metals. Results of analyses are summarized in Table 5-4. Total solids are shown as percent; volatile solids are shown as percent of total solids; nutrients (TKN, NH3-N, P) are shown as percent (dry weight basis); and metals are shown as mg/kg (dry weight basis). A more extensive summary of the quantity and quality of sludges from the various plants is listed in the Appendix of this report.

5.4 Landspreading

As shown in Tables 5-2 and 5-3, a portion of sludge generated at Commission treatment plants is landspread as a fertilizer supplement and soil conditioner. Prior to 1978, landspreading was limited to utilizing sludges, generated at the smaller treatment plants for application to adjacent farm land. All other sludges were ultimately dewatered and disposed of by incineration.

In 1978, a sludge application program was initiated at the Metropolitan Plant. Because solids processing facilities at the plant were limiting the removal of solids from the sewage, the plant could not consistently meet NPDES discharge limitations. The land application program was developed as a means of disposing sludge solids generated in excess of the existing capacity of sludge handling facilities. This land application program was continued throughout 1982, since renovation and construction of additional sludge handling facilities was not completed.

At the Metropolitan Plant, sludges are conditioned and dewatered to produce sludge cake. Two types of sludge cake are produced: filter cake and press cake. The filter cake is produced by treating sludge with chemicals and removing water with a vacuum filter. The press cake is produced by thermally conditioning the sludge and dewatering the resulting material in a press. Both chemical addition and heat treatment have been shown to reduce pathogenic organisms to an acceptable level.

Since the initiation of landspreading as a disposal method at the Metropolitan Plant, most of the dewatered sludge that is suitable for soil incorporation has been landspread. Table 5-5 presents a summary of sludge quantities disposed of by the landspreading program since 1978.

TABLE 5-4

1982 SLUDGE QUALITY SUMMARY

Treatment Plant		Total Solids %	Volatile Solids %	Cu mg/kg	Ni mg/kg	Pb mg/kg	Zn mg/kg	Cd mg/kg	Cr mg/kg	Hg mg/kg	pH	NH3-N %	KJN %	K %	P %	PCB mg/kg
Anoka	Avg.	1.78	63.6	1,542	281	579	1,730	10.1	1,934	4.9	7.4	5.48	10.3	0.49	3.17	0.8
	Range	----	----	1,343-2,087	221-408	432-951	1,427-2,427	6.7-15.5	1,404-2,767	2.7-7.8	7.0-7.9	3.1-7.8	6.9-14.9	0.3-0.7	2.6-3.9	0.7-0.8
Bayport	Avg.	2.15	61.4	250	25	145	750	7.2	55	4.5	6.7	0.12	4.15	0.25	3.24	0.2
	Range	----		186-337	14-36	113-193	567-1,193	4.8-10.9	34-131	2.8-6.9	6.2-7.1	0.06-0.24	2.1-5.8	0.2-0.3	1.8-4.1	-----
Blue Lake	Avg.	4.92	71.9	2,284	62	239	692	4.2	138	4.5	5.8	0.36	4.32	0.29	1.26	1.1
	Range	----		------	-----	----	------	-----	-------	----	-------	------	-----	-----	-----	-----
Chaska	Avg.	1.59	65.0	712	40	181	876	7.9	381	5.3	6.5	0.11	4.75	1.05	3.37	0.6
	Range	----		541-1,240	27-76	102-350	601-1,283	5.4-11.5	164-796	1.7-18.1	5.5-7.1	0.04-0.21	1.5-6.3	0.5-1.4	2.5-4.1	0.5-0.7
Cottage Grove	Avg.	1.63	67.4	492	106	183	1,098	8.8	53	3.9	7.4	4.39	9.42	0.58	2.63	0.3
	Range	----		426-571	83-126	155-210	935-1,463	5.6-10.8	29-132	1.9-5.9	7.0-7.8	2.9-8.8	6.8-13.5	0.4-0.9	2.0-3.3	-----
Empire	Avg.	13.2	61.7	1,235	38	225	5,118	11.4	182	5.7	8.0	1.39	6.12	0.18	3.34	1.0
	Range	----		1,084-1,809	27-54	169-276	4,044-6,000	9.0-14.3	140-264	3.7-12.2	7.5-8.2	1.1-3.8	5.0-7.7	0.1-0.3	2.8-4.3	-----
Hastings	Avg.	3.18	59.5	1,803	31	257	857	4.7	18,454	2.4	7.3	1.93	6.48	0.29	3.02	<0.4
	Range	----		888-2,682	22-42	166-447	255-1,143	3.7-6.4	14,613-22,880	1.1-6.8	7.0-7.6	1.3-2.2	5.3-8.3	0.2-0.4	2.2-3.8	<0.1-0.8
Maple Plain	Avg.	5.94	57.3	1,334	74	703	1,035	8.9	191	8.5	6.5	1.06	6.58	0.25	2.14	0.7
	Range	----		1,085-1,582	56-93	689-717	736-1,333	7.5-10.3	142-239	8.4-8.5	6.0-7.0	0.6-1.5	5.4-7.7	0.1-0.4	1.5-2.7	-----
Metropolitan																
F & I No. 1 Cake		27.6	58.8	783	169	314	1,317	33	786	1.5	11.1	.04	2.7	0.08	1.1	1.0
F & I No. 2 Cake		25.5	52.3	894	180	325	1,428	41	919	2.0	-------	.06	3.2	0.10	1.4	0.9
Plate & Frame Press Cake		47.8	64.6	1,574	222	413	2,745	89	1,758	2.4	-------	.09	3.4	0.09	2.8	1.7
Roll Press Cake*		25.0	74.3	728	112	197	1,154	26	800	1.8	-------	0.36	2.4	0.12	1.0	0.5
Savage	Avg.	4.88	57.0	1,326	48	387	1,094	9.0	151	65.1	7.1	0.97	4.92	0.19	2.18	1.4
	Range	----		1,132-1,604	39-57	326-436	868-1,228	7.8-9.8	119-191	7.0-94.1	6.8-7.3	0.6-1.3	3.4-5.8	0.2-0.3	1.3-2.6	1.3-1.6
Seneca	Avg.	23.5	46.3	940	141	299	542	9.5	301	2.4	-------	.06	3.0	.08	1.3	0.6
	Range	----		602-1,219	49-481	179-472	387-1,009	6.4-12.7	182-529	1.6-3.9	-------	.05-.08	2.2-3.5	.08-0.1	1.1-1.5	0.2-1.1
Stillwater	Avg.	2.68	51.4	688	33	180	1,478	8.0	128	4.3	7.2	2.81	6.63	0.33	3.90	0.2
	Range	----		479-1,441	21-90	120-378	1,040-3,604	5.9-18.0	7-246	1.7-22.1	7.0-7.5	1.7-6.1	4.0-14.1	0.2-0.8	3.1-6.9	-----

*Data represents operation during Nov. and Dec., 1982.

TABLE 5-5

SUMMARY OF QUANTITIES OF METROPOLITAN PLANT
DEWATERED SLUDGE DISPOSED OF BY LANDSPREADING PROGRAM

Year	Agricultural Land (wet tons)	Other (wet tons)	Total wet tons disposed by landspreading
1978	13,700	------	13,700
1979	18,700	15,500	34,200
1980	75,600	29,600	105,200
1981	189,600	9,900	199,500
1982	184,600	11,145	195,745

In addition to disposing of sludge cake directly on land, portions of cake are composted prior to land application. Composting provides for additional destruction of pathogenic organisms and organic matter.

All land application of sludge is done under permits from MPCA. Each permit is granted for an individual parcel of land and specifies the maximum sludge application rate per acre. These application rates are based upon maximum allowable application rates of the various chemical constituents of the sludge (NH_3, Cd, etc.). All sludge is analyzed before applications to ensure meeting conditions of each permit.

During 1982, approximately 185,000 wet tons of dewatered sludge was applied to 180 permitted sites. The permitted sites totaled approximately 5,700 acres and corn was the principal crop grown on the sludge amended land. An additional 11,000 wet tons of dewatered sludge were composted during 1982. The composting was accomplished using the static aerated pile method with wood chips as a bulking agent. Composted dewatered sludge was used primarily to establish turf grasses on public areas such as parks and cemetaries.

In addition to landspreading of dewatered sludge from the Metropolitan Plant, approximately three million gallons of liquid sludge generated at the Cottage Grove, Hastings, Savage, and Stillwater Plants were applied to private farm lands or utilized at the University of Minnesota Experimental Agricultural Station. Approximately 4,100 wet tons of digested dewatered sludge from the Empire Plant were applied to adjacent farm land owned by the Commission.

6.0 INDIVIDUAL TREATMENT PLANT REPORTS

This section contains the individual treatment plant reports for 1982. For each plant report there is an introduction briefly describing the background of the plant, its design basis, 1982 performance and activities, and a statement regarding the future of the plant. The introduction is followed by a listing of 1982 unit process loadings and a liquid and solids flow diagram of the treatment process. In addition, a graphical presentation of flows for individual months of 1982 and annual average flows for 1971-1982 is included. Monthly flow data are shown as a vertical bar corresponding to the range of flow for that month with the top cross bar representing the maximum flow and the bottom cross bar the minimum flow. A solid line connects the vertical bars and is drawn to the average wastewater flow for that month. Flow data are followed by 1982 monthly influent and effluent summaries. These tables contain monthly and annual average data on virtually all of the parameters for which the influent and effluent of that plant are analyzed.

Graphs of BOD and TSS for 1982 show a vertical bar which encompasses the maximum and minimum parameter range for that month. The solid line connects the monthly averages. Fecal coliform data are also presented graphically with the 1971-1982 annual averages (arithmetic average of monthly geometric means) shown on one graph and the 1982 monthly geometric means shown on another graph. Finally, plots of effluent BOD and TSS are shown illustrating the percent of the time the effluent concentrations were less than or equal to a given value. On these graphs, data from 1974-1981 are compared to data obtained during 1982.

ANOKA WASTEWATER TREATMENT PLANT

Plant History and Description

The Anoka Plant was designed by Toltz, King, DuVall, Anderson and Associates and built in two stages. The original plant was constructed in 1954-55, with a design capacity of 1.4 mgd. The plant was expanded in 1969 to its present design capacity of 2.46 mgd. The Anoka Plant serves the communities of Anoka, Champlin, and Ramsey in Service Area No. 3.

Liquid treatment consists of screening, grit removal, influent pumping, primary sedimentation, primary effluent pumping, conventional activated sludge aeration, final clarification, chlorination, and discharge to the Mississippi River.

Solids processing consists of combined thickening in primary tanks, anaerobic digestion, and sludge hauling for disposal in the Metropolitan Plant Interceptor System.

The plant is presently operating at about 85 percent of its rated capacity and provides good BOD and TSS removal. Significant flow increases are anticipated in the next two years which may exceed the capacity of certain process units. These additional flow sources are from the construction of the Anoka Interceptor and a Champlin Station expansion. The plant is subject to secondary treatment limits and additional limits on heavy metals and cyanide.

Performance

Plant flow averaged 2.14 mgd in 1982, up slightly from 2.01 mgd in 1981. Average plant effluent quality was 12 mg/L BOD and 8 mg/L TSS. Plant performance was good throughout the year, although two NPDES Permit violations occurred due to failure to comply with weekly effluent fecal coliform limitations. Statistical analysis of data show the following trend in effluent BOD and TSS from 1979 through 1982.

Effluent Concentration, mg/L

	50% of Time				75% of Time				90% of Time			
	1979	1980	1981	1982	1979	1980	1981	1982	1979	1980	1981	1982
BOD	12	12	15	10	16	17	20	14	22	22	26	19
TSS	10	10	12	7	15	15	18	10	21	20	24	15

Future

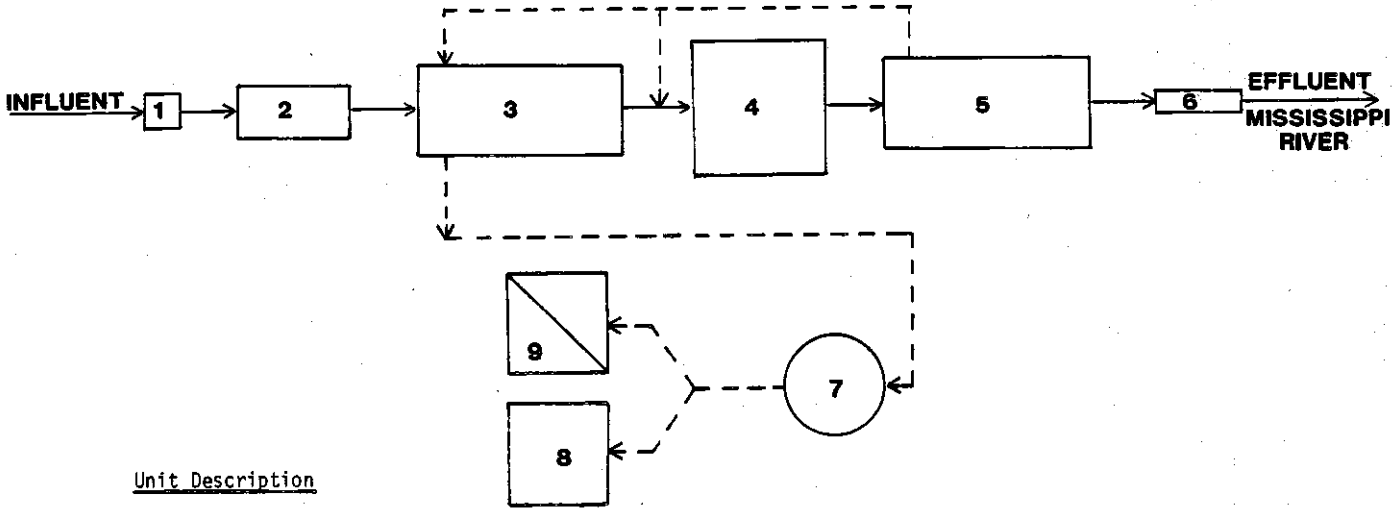
The plant will continue to serve Service Area No. 3 until the late 1980's, when it is scheduled for phase-out, with flow transported to the Metropolitan Plant. Plant phase-out is contingent upon completion of the Champlin-Anoka-Brooklyn Park (CAB) Interceptor. In the interim period prior to phase-out no major plant improvements are scheduled. Limited capital improvements may be necessary to ensure adequate capacity in the interim.

ANOKA PLANT PROCESS UNIT LOADINGS
1982

Parameter	Annual Average	Maximum Month
Wastewater Flow, MGD	2.14	2.34
BOD Loading, lb/day	3,980	4,500
TSS Loading, lb/day	2,770	3,160
COD Loading, lb/day	6,350	7,120
Sludge Production, lb/day	1,500	1,970
Grit Removal		
Overflow Rate, gpd/Sq. Ft.	41,150	45,000
Primary Sedimentation		
Detention Time, Hr.	2.0	1.9
Weir Overflow Rate, gpd/Lin. Ft.	7,980	8,730
Surface Overflow Rate, gpd/Sq. Ft.	715	780
Aeration Tanks		
Detention Time, Hr.	7.9	7.2
BOD Loading, lb/Day/1000 Cu. Ft.	43	48
Final Sedimentation		
Detention Time, Hr.	3.6	3.3
Weir Overflow Rate, gpd/Lin. Ft.	6,560	7,180
Surface Overflow Rate, gpd/Sq. Ft.	500	550
Chlorination		
Contact Time, Minutes	37	34
Chlorine Use, lb/Day	123	146
Anaerobic Digestion (Primary Digester Only)		
Solids Loading, lb/Cu. Ft./Day	0.08	0.10
Detention Time, Days	20.0	15.8
Sludge Transport		
Volume, Gal./Day	10,930	14,040

ANOKA WASTEWATER TREATMENT PLANT

FLOW DIAGRAM



Unit Description

Liquid Phase

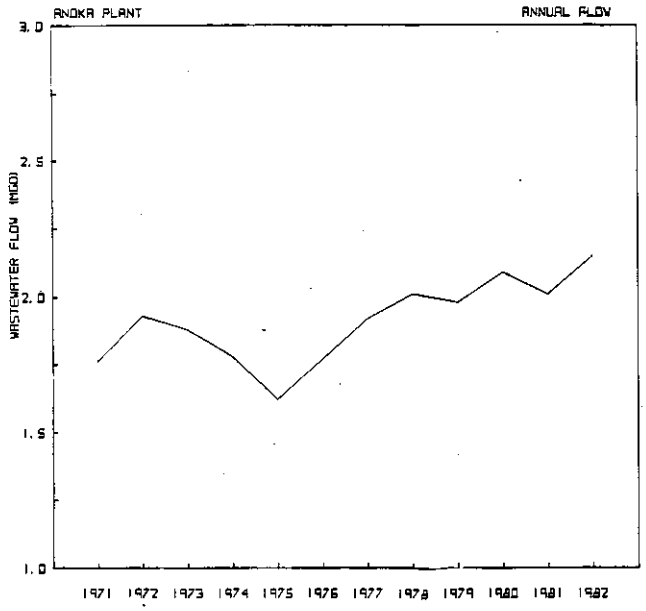
1. Screening
2. Grit Removal
3. Primary Sedimentation
4. Activated Sludge
5. Final Sedimentation
6. Chlorination

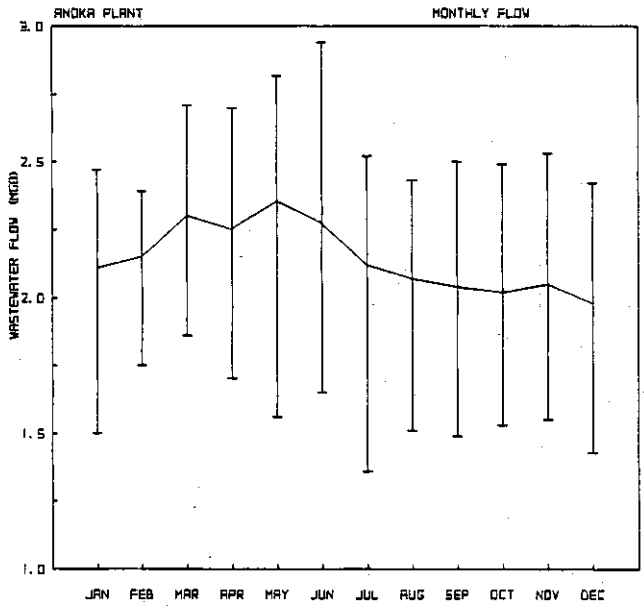
Solids Phase

7. Anaerobic Digestion
8. Landspreading
9. Disposal at Metro Plant

Legend

- Liquid Flow
- Solids Transfer
- Existing Processing Units
- Future Process Units



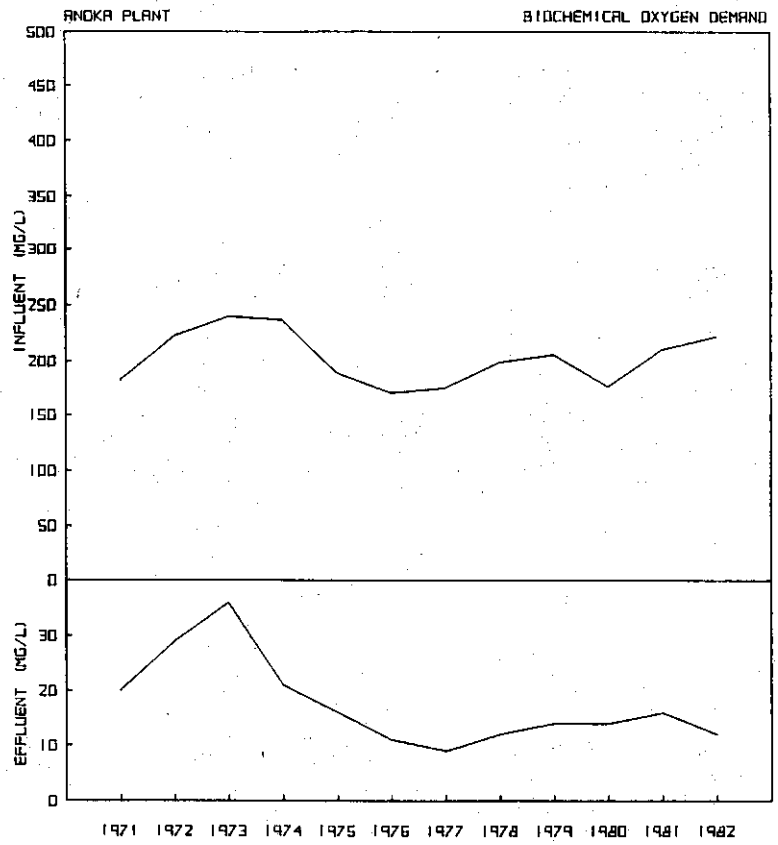


MONTHLY SUMMARY OF INFLUENT QUALITY
TREATMENT PLANT: Anoka

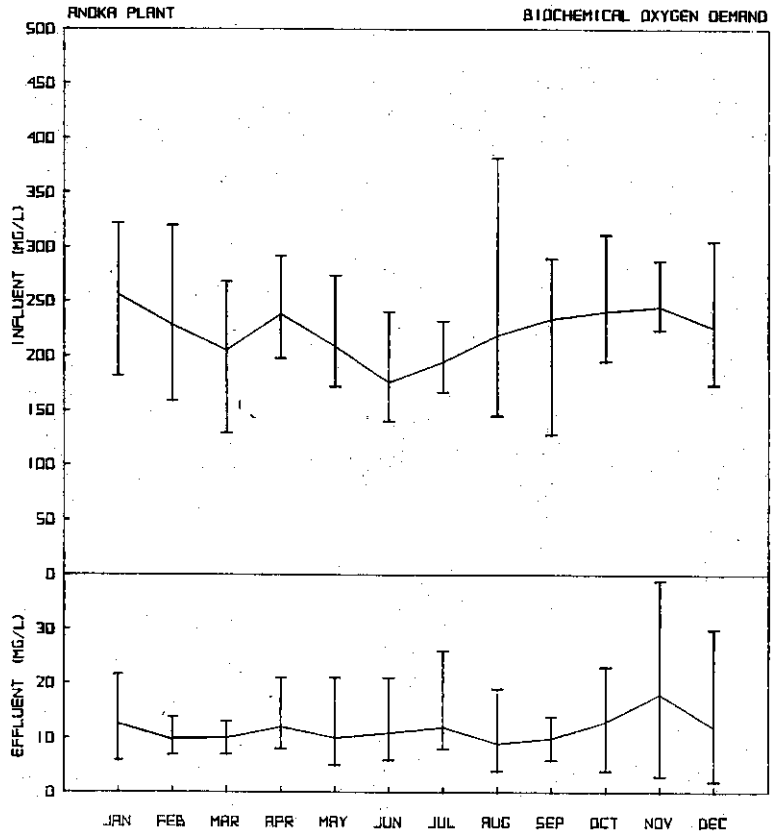
Month	Wastewater Flow, MGD	Temperature °C	TBOD mg/l	TSS mg/l	pH Range	KJN mg/l	Total-P mg/l	NH_3 mg/l	COD mg/l
JANUARY	2.11	14	256	157	7.6-8.1	38.6	7.9	19.7	345
FEBRUARY	2.15	14	228	142	7.7-8.1	37.5	6.8	20.1	357
MARCH	2.30	14	205	144	7.7-8.1	32.5	6.4	18.9	348
APRIL	2.25	14	238	139	7.7-8.2	34.4	5.8	19.4	374
MAY	2.34	15	209	158	7.7-8.2	36.0	7.0	19.5	365
JUNE	2.27	17	176	128	7.6-8.2	32.0	5.9	15.6	312
JULY	2.12	20	195	122	7.7-8.1	34.8	5.5	18.0	304
AUGUST	2.07	21	219	150	7.7-8.2	34.4	6.2	16.4	324
SEPTEMBER	2.04	20	234	172	7.5-8.3	42.4	7.5	19.6	362
OCTOBER	2.02	19	241	170	7.2-8.2	43.9	7.1	21.0	390
NOVEMBER	2.05	17	245	185	7.0-8.4	39.0	6.4	22.8	389
DECEMBER	1.98	15	226	181	7.0-8.3	49.4	9.2	32.2	399
1982 AVERAGE	2.14	17	223	154	7.0-8.4	37.9	6.8	20.3	356
1981 AVERAGE	2.01	18	211	152	7.5-8.7	----	---	----	362

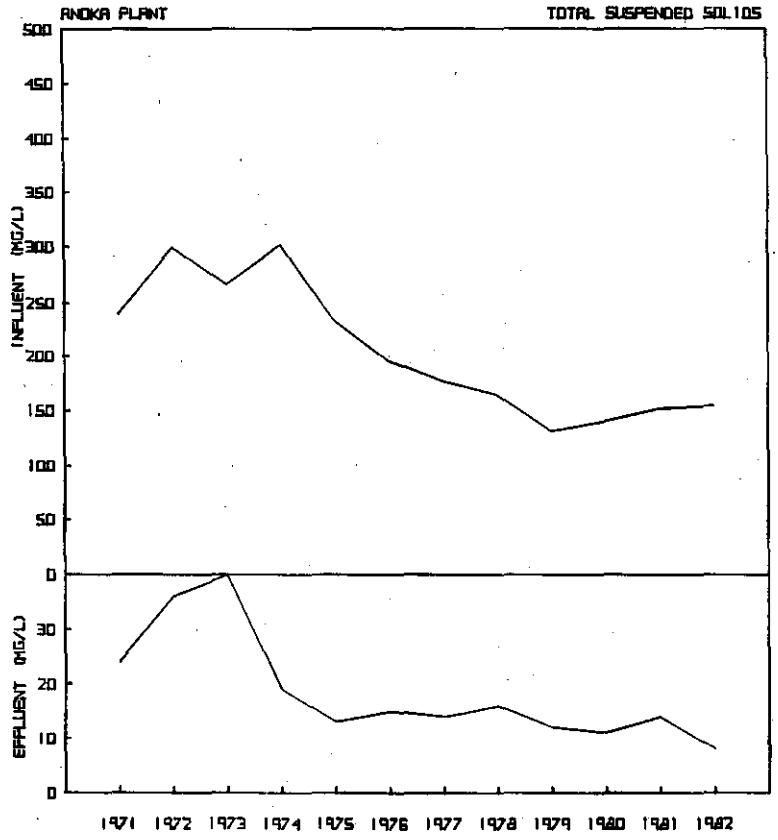
MONTHLY SUMMARY OF EFFLUENT QUALITY
TREATMENT PLANT: Anoka

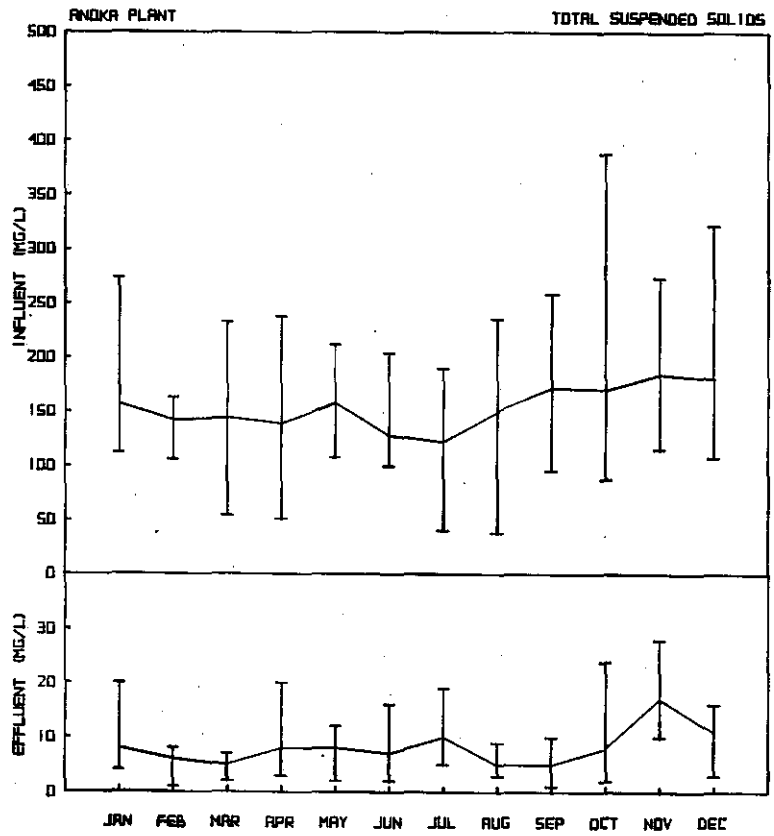
Month	TBOD mg/l	CBOD mg/l	COD mg/l	TSS mg/l	FECAL COLI Geo Mean no/100 ml	TURB NTU	KJN mg/l	NH_3 mg/l	NO_2 mg/l	NO_3 mg/l	Total P mg/l	Cl2 Used lbs	Cl2 Res mg/l	DO mg/l	pH Range	% Removal BOD	% Removal TSS
NPDES LIMIT	25	25	--	30	200	25	----	----	----	----	---	---	---	---	6.5-8.5	--	--
JANUARY	18	13	59	8	43	5	23.4	16.0	0.10	0.19	4.1	129	6.9	1.3	7.3-7.5	95	95
FEBRUARY	11	10	67	6	17	4	23.3	16.7	0.07	0.44	3.4	125	6.0	1.2	7.3-7.6	96	96
MARCH	11	10	71	5	131	4	22.6	16.6	0.09	0.16	3.7	108	5.0	1.3	7.3-7.6	95	97
APRIL	14	12	83	8	21	6	25.0	17.2	0.07	0.09	3.5	108	5.9	1.3	7.3-7.6	95	94
MAY	12	10	67	8	71	6	22.4	16.7	0.16	0.12	3.7	122	5.6	1.1	7.3-7.6	95	95
JUNE	14	11	75	7	33	5	20.2	13.9	0.75	0.15	3.8	134	4.7	0.8	7.2-7.7	94	95
JULY	17	12	65	10	15	7	22.8	15.0	1.05	0.35	3.5	119	5.3	1.0	7.2-7.5	94	92
AUGUST	11	9	57	5	10	5	16.8	10.6	1.27	0.48	3.5	146	5.2	1.2	7.3-7.5	96	96
SEPTEMBER	13	10	58	5	54	4	16.3	10.1	1.68	0.56	3.7	138	5.1	1.1	7.3-7.6	96	97
OCTOBER	15	13	72	8	30	5	27.1	16.2	0.58	0.68	3.9	118	5.7	1.1	7.2-7.6	95	95
NOVEMBER	19	18	84	17	115	8	27.4	20.2	0.39	0.11	4.1	99	5.6	1.1	7.3-7.6	93	91
DECEMBER	14	12	67	11	37	6	29.2	19.9	0.71	0.24	3.8	125	5.3	1.2	7.2-7.5	95	94
1982 AVG.	14	12	69	8	48	5	23.0	15.8	0.58	0.30	3.7	123	5.5	1.1	7.2-7.7	95	95
1981 AVG.	16	--	92	14	36	6	18.6	14.4	1.05	0.39	3.4	123	6.0	1.3	7.0-7.8	92	91

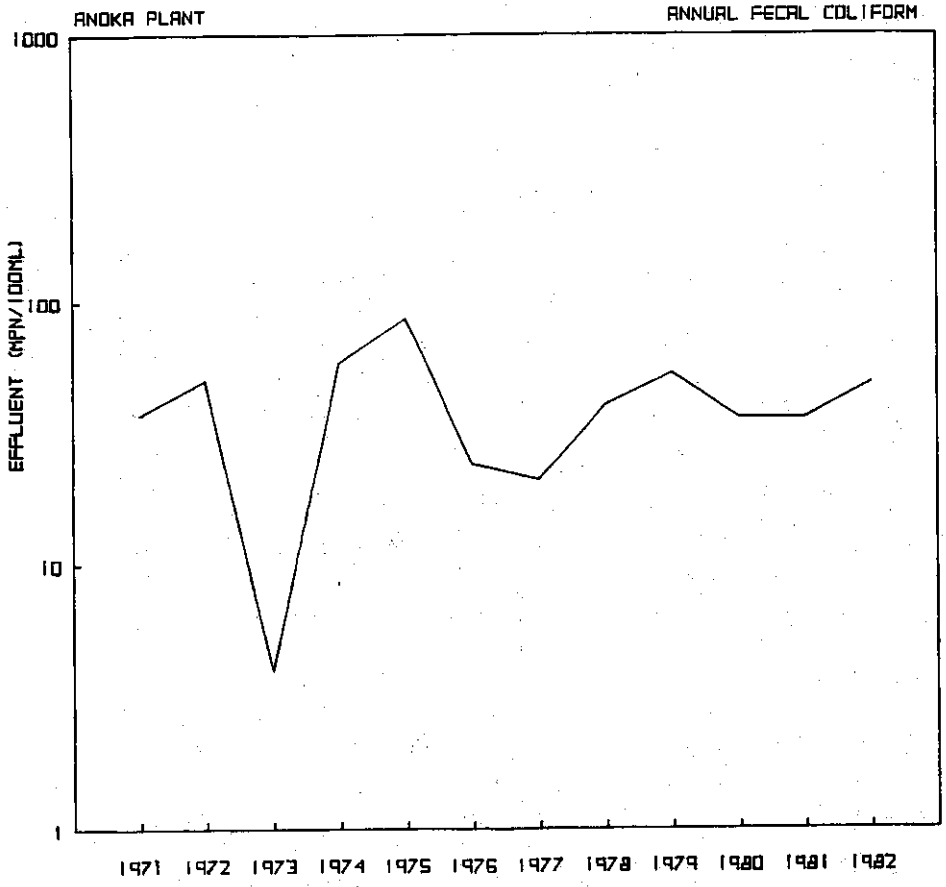


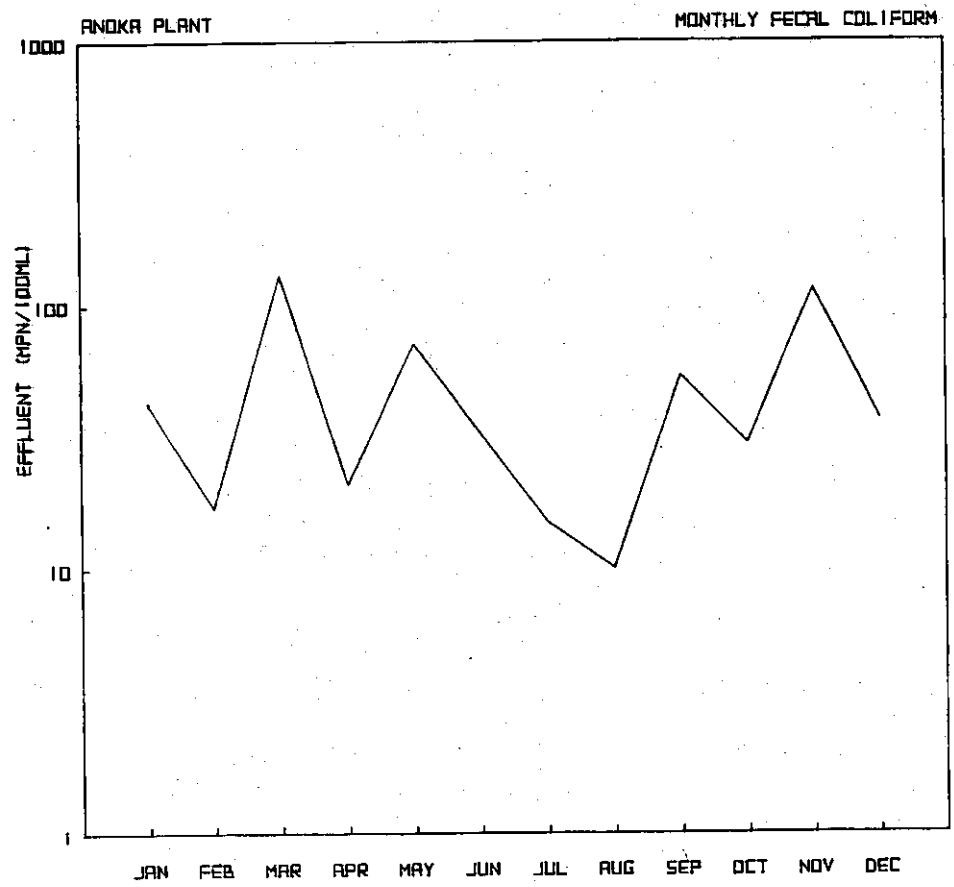
DATA REPRESENTS CBOD IN 1982. ALL PREVIOUS YEARS DATA ARE TBOD.

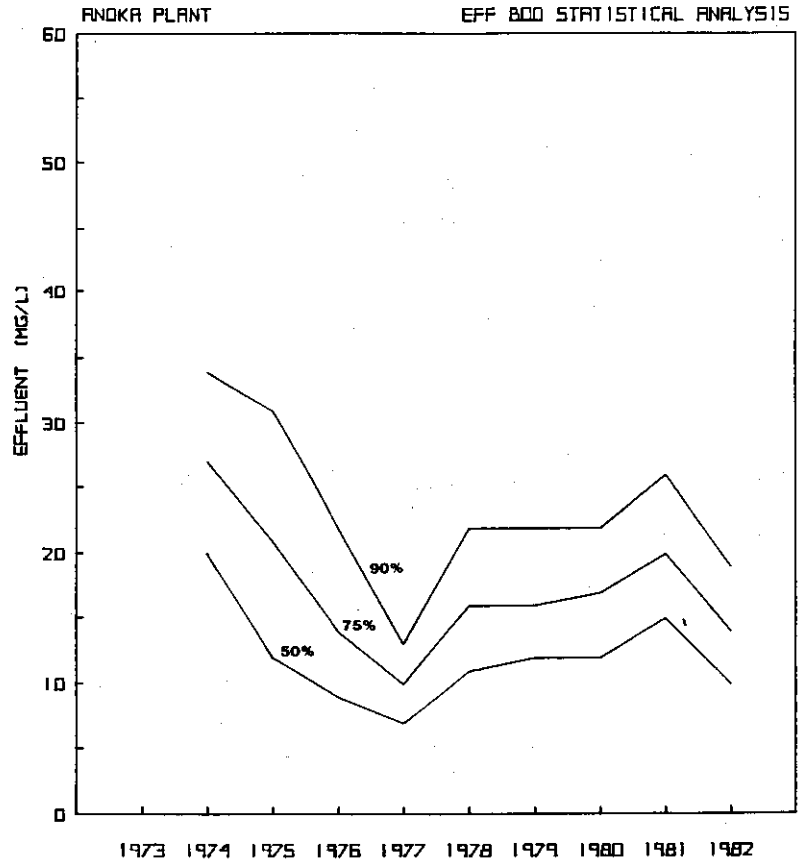


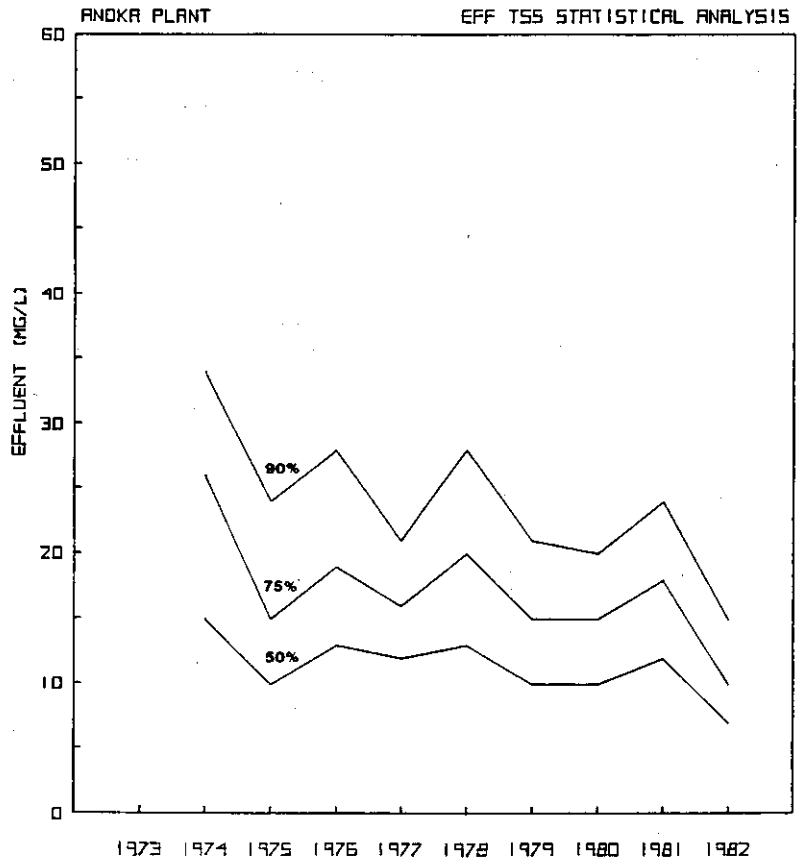

ANOKA PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
EFFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
30
20
10
0
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982


ANOKA PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
EFFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
30
20
10
0
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


ANOKA PLANT
ANNUAL FECAL COLIFORM
1000
100
10
1
EFFLUENT (MPN/100ML)
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982


ANOKA PLANT
MONTHLY FECAL COLIFORM
1000
100
10
1
EFFLUENT (MPN/100ML)
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


ANOKA PLANT
EFF BOD STATISTICAL ANALYSIS
EFFLUENT (MG/L)
60
50
40
30
20
10
0
90%
75%
50%
1973 1974 1975 1976 1977 1978 1979 1980 1981 1982


ANOKA PLANT
EFF TSS STATISTICAL ANALYSIS
EFFLUENT (MG/L)
60
50
40
30
20
10
0
90%
75%
50%
1973 1974 1975 1976 1977 1978 1979 1980 1981 1982

1982 EFFLUENT DATA
TREATMENT PLANT Anoka

MONTH	Cu mg/l	Cr mg/l	Zn mg/l	Pb mg/l	Cd mg/l	Hg ug/l	CN mg/l	As ug/l	Sn mg/l	Ni mg/l	Phenol ug/l	Fe mg/l	PCB ug/l
NPDES Limit	0.30	0.40	0.50	0.05			0.500						
January	<0.02	<0.05	0.07	<0.05			<0.024						
February	<0.03	<0.07	0.08	<0.05			0.043						
March	0.02	<0.05	0.06	<0.05			0.049						
April	<0.02	<0.05	0.10	<0.05			0.071						
May	0.03	<0.05	0.09	<0.05			0.161						
June	0.03	<0.05	0.09	<0.05			0.206						
July	0.04	<0.05	0.08	<0.05			<0.227						
August	0.04	<0.05	0.07	<0.05			0.187						
September	0.03	<0.05	0.13	<0.05			0.115						
October	0.04	<0.06	0.06	<0.05			0.198						
November	0.04	<0.05	0.12	<0.05			0.308						
December	0.04	<0.05	0.14	<0.05			0.144						
1982 Avg.	<0.03	<0.05	0.09	<0.05			<0.144						

BAYPORT WASTEWATER TREATMENT PLANT

Plant History and Description

The original Bayport Wastewater Treatment Plant was built in 1939, consisting of a primary clarifier, two mechanical aeration tanks, final clarifier, chlorine contact tank, heated anaerobic digester, drying beds, and a control and pumping building. In 1956, the digester was converted to external heating, and a sludge recirculating pump added. In 1958, the plant was expanded by addition of a chlorine contact tank, an aeration tank, a final settling tank, an anaerobic digester, a barminutor, and a drying bed.

In 1964, extensive plant remodeling and additions, designed by Banister, Short, Elliot, Hendrickson, and Associates were completed. In 1973, chemical feed for phosphorus removal was provided and in 1982, mechanical screening was replaced by a stationary hydrasieve fine screening mechanism.

Liquid treatment consists of screening, influent pumping, contact stabilization, activated sludge aeration, alum addition for phosphorus removal, final clarification, chlorination, and discharge to Lake St. Croix (the St. Croix River).

Solids processing consists of aerobic digestion and sludge hauling to the Metropolitan Plant Interceptor System.

The Bayport Plant is presently operating at about 80 percent of its design capacity, and is subject to secondary treatment limits and a phosphorus limit of 1 mg/L.

Performance

Plant flow averaged 0.52 mgd in 1982, slightly higher than 0.47 mgd in 1981. Average plant effluent quality was 8 mg/L BOD, 8 mg/L TSS, and 0.5 mg/l P. Plant performance was excellent throughout the year, with no NPDES Permit violations. Statistical analysis of data show the following trend in effluent BOD and TSS from 1979 through 1982.

Effluent Concentration, mg/l

	50% of Time				75% of Time				90% of Time			
	1979	1980	1981	1982	1979	1980	1981	1982	1979	1980	1981	1982
BOD	6	5	7	7	8	8	8	9	11	11	10	13
TSS	7	7	7	7	10	9	9	9	13	11	10	12

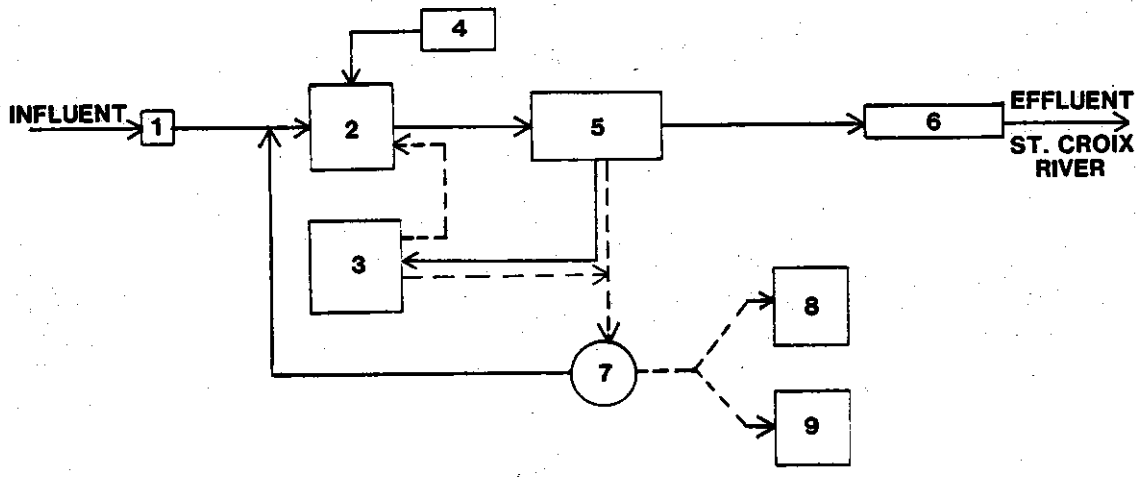
Future

The long-term plan for this plant is to phase it out of service and divert flows to the Stillwater Plant. This is projected to occur in the late 1980's or early 1990's, when the plant is expected to reach its capacity.

BAYPORT PLANT PROCESS LOADINGS
1982

Parameter	Annual Average	Maximum Month
Wastewater Flow, MGD	0.52	0.65
BOD Loading, lb/day	698	968
TSS Loading, lb/day	664	999
COD Loading, lb/day	1,227	1,453
Aeration Basin		
BOD Loading, lb/Day/1000 Cu. Ft.	21	29
Alum Feed Rate, lb/day	100	133
Final Sedimentation		
Weir Overflow Rate, gpd/Lin. Ft.	4,260	5,330
Surface Overflow Rate, gpd/Sq. Ft.	430	540
Chlorination		
Contact Time, Minutes	60	48
Chlorine Use, lb/day	29	34
Aerobic Digestion		
Solid Retention Time, day	31	26
Sludge Transport		
Volume, gpd	3,400	4,040
Mass, lb/day	610	749

BAYPORT WASTEWATER TREATMENT PLANT
FLOW DIAGRAM



Unit Description

Liquid Phase

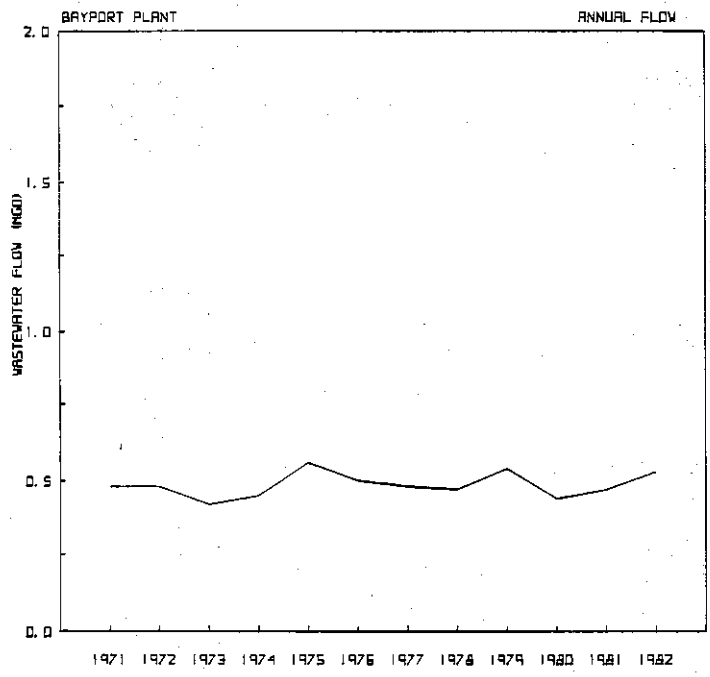
1. Screening
2. Activated Sludge
3. Sludge Reaeration
4. Chemical Addition
5. Final Sedimentation
6. Chlorination

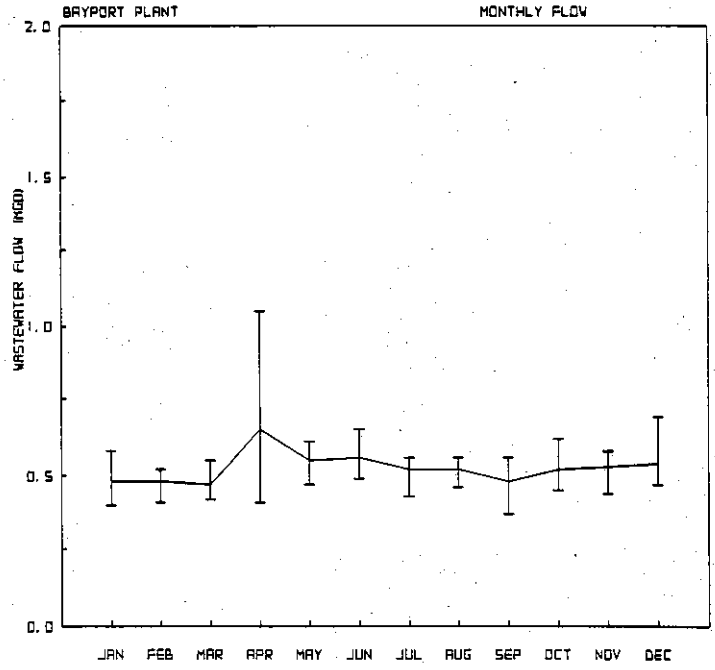
Solids Phase

7. Aerobic Digestion
8. Sand Drying Beds
9. Land Spread

Legend

- Liquid Flow
- Solids Transfer
- Existing Process Units
- Future Process Units



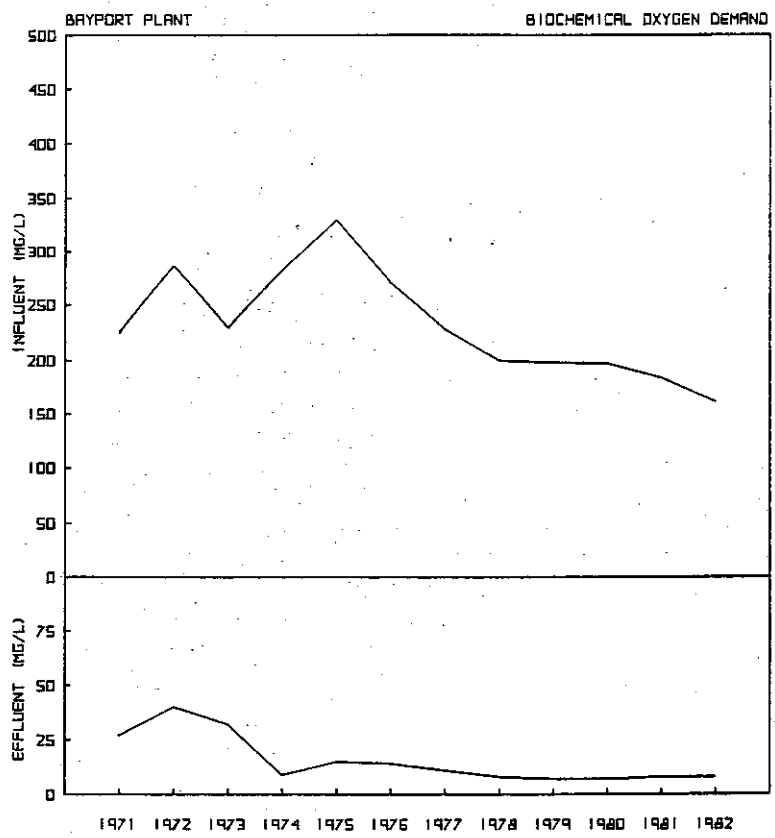


MONTHLY SUMMARY OF INFLUENT QUALITY
TREATMENT PLANT: Bayport

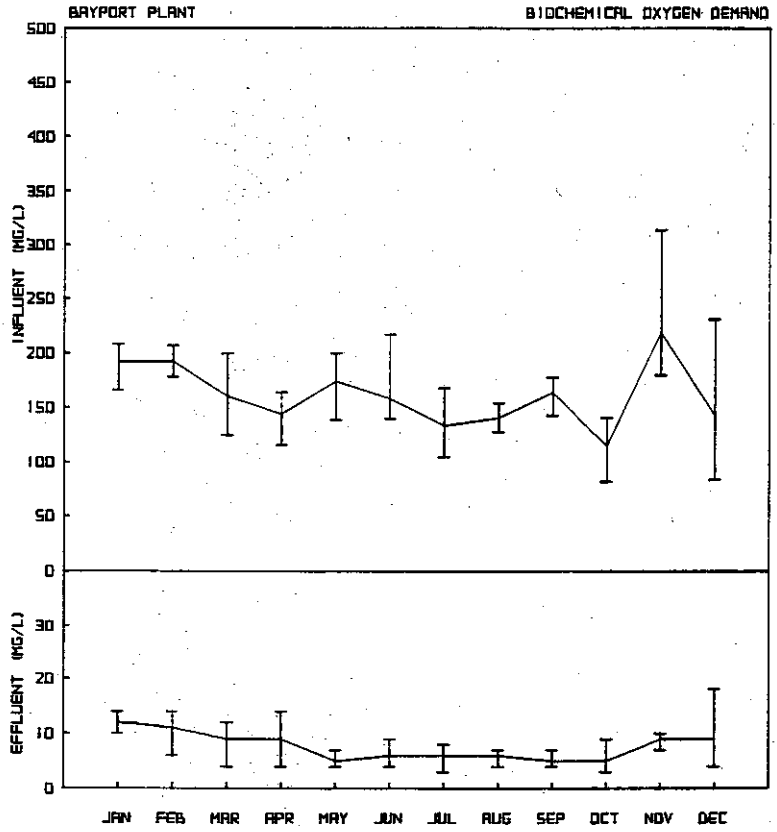
Month	Wastewater Flow, MGD	Temperature °C	TBOD mg/l	TSS mg/l	pH Range	KJN mg/l	Total-P mg/l	NH_3 mg/l	COD mg/l
JANUARY	0.48	18	192	130	6.0-10.0	30.6	5.4	17.4	284
FEBRUARY	0.48	18	192	162	6.4-8.6	28.2	4.8	15.5	331
MARCH	0.47	17	160	136	6.2-9.4	29.2	5.1	17.8	296
APRIL	0.65	17	144	123	5.0-9.2	20.9	4.0	11.3	268
MAY	0.55	20	174	153	6.2-8.6	30.4	5.8	16.5	300
JUNE	0.56	20	158	175	6.8-8.8	30.8	6.3	17.1	298
JULY	0.52	23	134	161	6.2-8.6	26.5	5.3	13.8	281
AUGUST	0.52	23	141	120	6.4-9.8	27.0	5.1	15.3	255
SEPTEMBER	0.48	22	164	132	6.2-8.2	29.7	6.1	16.6	271
OCTOBER	0.52	20	115	155	6.0-8.6	26.4	5.6	14.2	210
NOVEMBER	0.53	19	219	226	6.2-8.8	30.8	6.5	16.3	297
DECEMBER	0.54	18	143	132	6.4-8.4	30.2	6.2	19.1	306
1982 AVERAGE	0.52	20	161	150	5.0-10.0	28.4	5.5	15.9	283
1981 AVERAGE	0.47	19	184	165	6.0-9.6	----	---	----	316

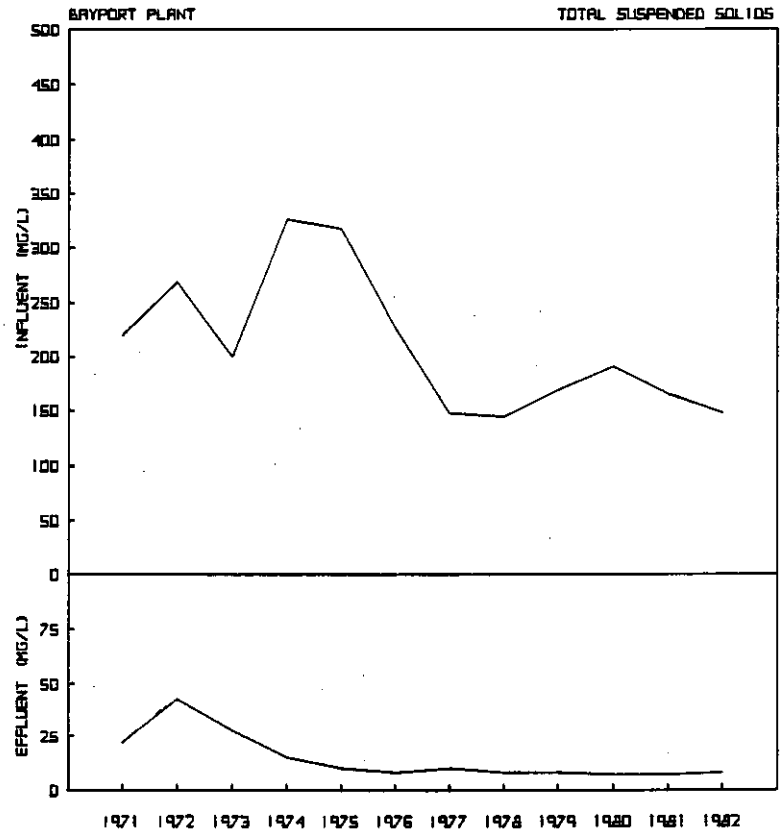
MONTHLY SUMMARY OF EFFLUENT QUALITY
TREATMENT PLANT: Bayport

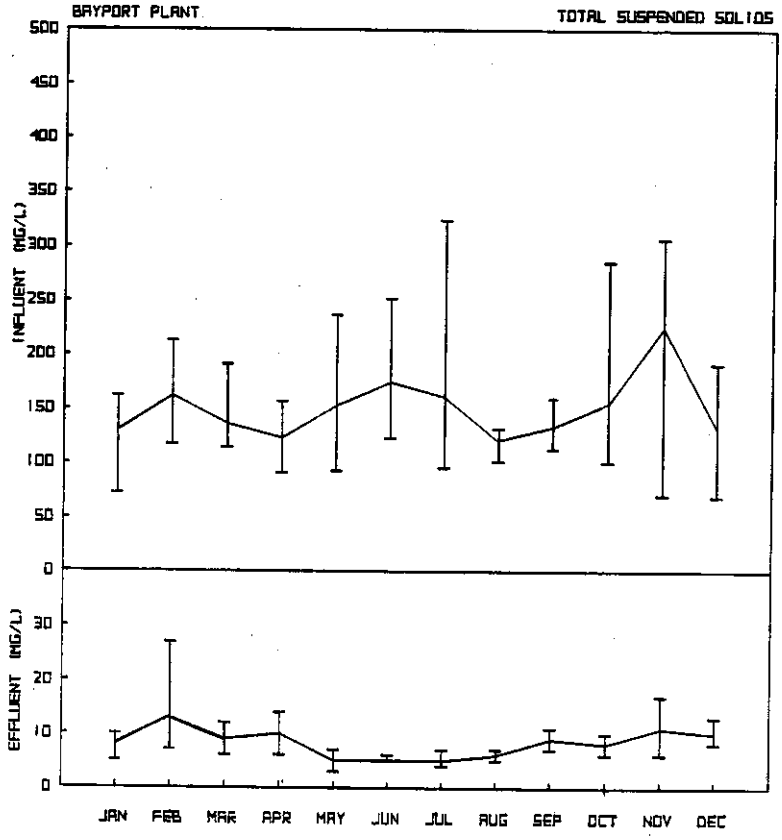
Month	TBOD mg/l	CBOD mg/l	COD mg/l	TSS mg/l	FECAL COLI Geo Mean no/100 ml	TURB NTU	KJN mg/l	NH_3 mg/l	NO_2 mg/l	NO_3 mg/l	Total P mg/l	Cl2 Used lbs	Cl2 Res mg/l	DO mg/l	pH Range	% Removal BOD	% Removal TSS
NPDES LIMIT	25	25	--	30	200	25	---	---	-----	------	1.0	--	---	---	6.5-8.5	--	--
JANUARY	17	12	27	8	---	4	7.4	4.7	0.37	10.64	0.5	--	---	4.1	7.0-7.2	94	94
FEBRUARY	14	11	36	13	---	5	6.3	4.5	0.38	10.26	0.4	--	---	3.9	6.9-7.2	95	92
MARCH	9	9	40	9	2	5	6.1	5.0	0.04	11.75	0.5	30	3.6	4.2	6.8-7.1	95	94
APRIL	10	9	41	10	3	5	6.9	3.9	0.11	8.40	0.5	30	3.4	3.9	6.9-7.2	94	92
MAY	5	5	26	5	3	3	5.8	4.1	0.16	6.26	0.3	30	2.6	3.6	6.9-7.1	97	97
JUNE	6	6	34	5	4	3	4.7	2.8	0.18	13.20	0.6	30	2.2	3.4	6.8-7.1	96	97
JULY	6	6	21	5	7	3	4.3	3.3	0.17	12.34	0.3	30	2.2	3.3	6.9-7.1	96	97
AUGUST	7	6	23	6	3	3	5.0	3.0	0.26	11.73	0.4	34	2.5	3.2	6.8-7.0	96	95
SEPTEMBER	6	5	27	9	2	4	5.7	2.6	0.48	12.90	0.6	30	2.4	3.9	6.8-7.3	97	94
OCTOBER	6	5	27	8	16	3	5.1	1.8	0.77	13.11	0.5	30	2.0	3.4	6.9-7.1	96	95
NOVEMBER	16	9	26	11	---	3	4.7	3.0	0.95	10.29	0.7	--	---	3.8	7.0-7.1	96	95
DECEMBER	20	9	23	10	---	2	3.2	2.0	0.68	9.72	0.6	--	---	3.7	6.8-7.1	94	93
1982 AVG.	10	8	29	8	5	4	5.4	3.4	0.38	10.88	0.5	30	2.6	3.7	6.8-7.3	95	94
1981 AVG.	8	--	29	7	2	3	6.3	3.7	0.35	12.18	0.4	34	3.5	3.6	6.8-7.3	96	96

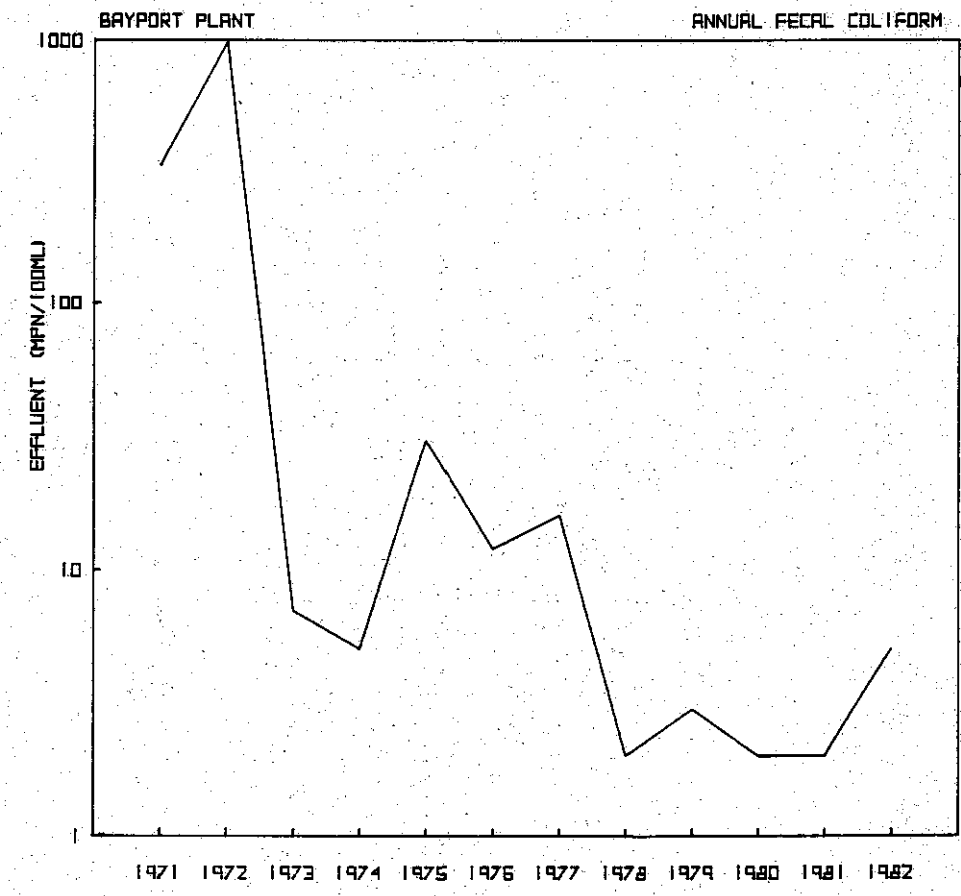


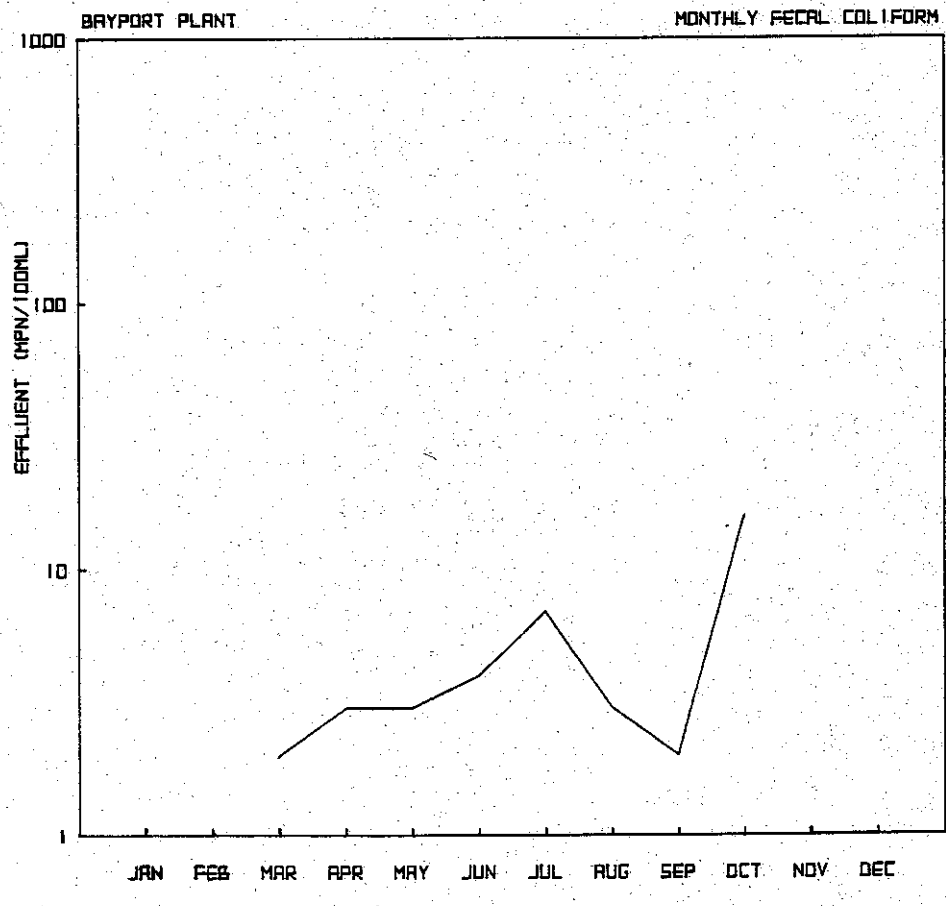
DATA REPRESENTS CBOD IN 1982. ALL PREVIOUS YEAR'S DATA ARE TBOD.

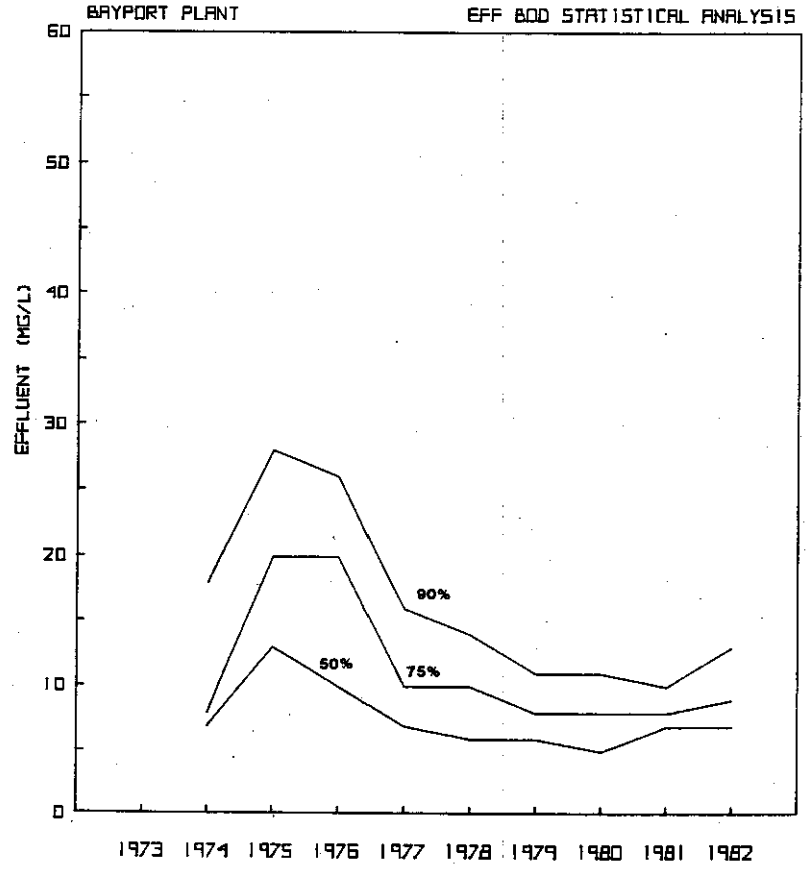


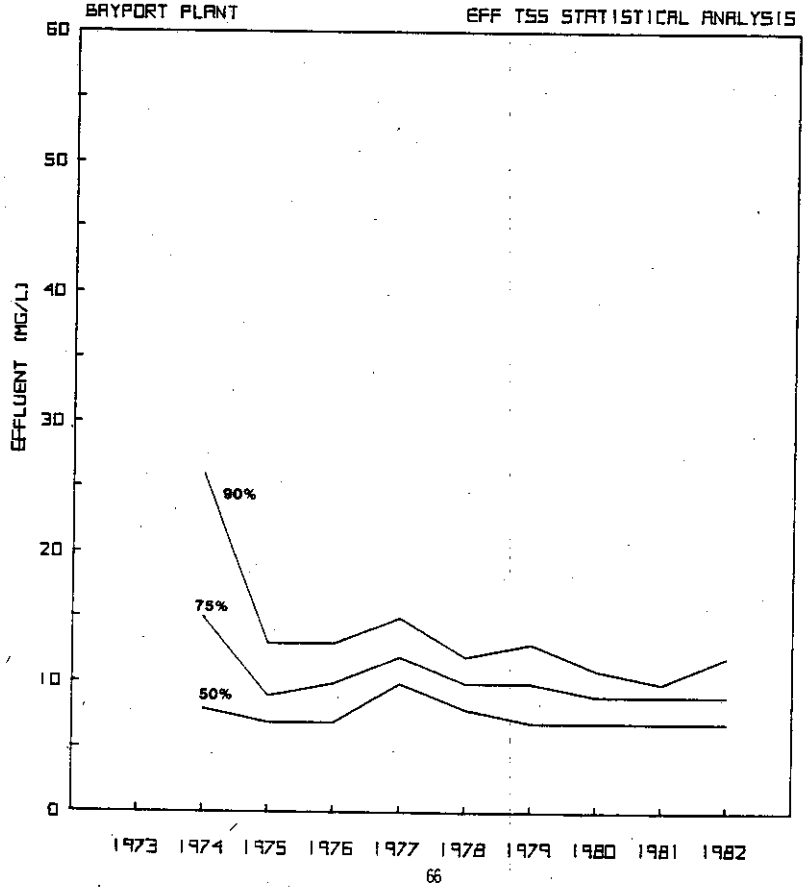

BAYPORT PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
EFFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
75
50
25
0
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982


BAYPORT PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
EFFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
30
20
10
0
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


BAYPORT PLANT
ANNUAL FECAL COLIFORM
1000
100
10
1
EFFLUENT (MPN/100ML)
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982


BAYPORT PLANT
MONTHLY FECAL COLIFORM
1000
100
10
1
EFFLUENT (MPN/100ML)
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


BAYPORT PLANT
EFF BOD STATISTICAL ANALYSIS
EFFLUENT (MG/L)
60
50
40
30
20
10
0
90%
75%
50%
1973 1974 1975 1976 1977 1978 1979 1980 1981 1982


BAYPORT PLANT
EFF TSS STATISTICAL ANALYSIS
EFFLUENT (MG/L)
60
50
40
30
20
10
0
90%
75%
50%
1973 1974 1975 1976 1977 1978 1979 1980 1981 1982

BLUE LAKE WASTEWATER TREATMENT PLANT

Plant History and Description

The Blue Lake Wastewater Treatment Plant was designed by Rieke-Carroll-Muller and Associates to be built in several stages and treat wastewater contributed by Sewer Service Area No. 4. Stage I, placed in operation in July, 1971, consisted of an aerated pond and chlorination facilities to provide temporary wastewater treatment. Stage II, consisting of the liquid treatment portion of a secondary treatment activated sludge plant, utilizing the existing aerated pond as an effluent polishing pond was constructed in 1973. Stage III, consisting of sludge processing facilities has not yet been constructed.

Liquid treatment consists of screening, primary sedimentation, complete mix activated sludge aeration with integral final clarification, an effluent polishing pond, chlorination, and discharge to the Minnesota River.

Solids processing consists of sludge thickening in spare primary clarifiers and sludge hauling to either the Seneca or Metropolitan Plant.

The Blue Lake Plant is operating at approximately 80 percent of its capacity and is subject to secondary treatment limits.

Performance

Plant flow averaged 16.1 mgd in 1982, considerably higher than 13.7 mgd in 1981. Average plant effluent quality was 10 mg/L BOD and 7 mg/L TSS. Plant performance was excellent throughout the year with no NPDES Permit violations. Statistical analysis of data show the following trend in effluent BOD and TSS from 1979 through 1982.

Effluent Concentration, mg/l

	50% of Time				75% of Time				90% of Time			
	1979	1980	1981	1982	1979	1980	1981	1982	1979	1980	1981	1982
BOD	7	8	9	10	10	10	13	13	15	14	19	16
TSS	11	8	6	6	14	11	7	8	17	15	19	10

Future

The Blue Lake Plant is one of the Commission's permanent regional treatment plants. Space is available for future expansions to serve Sewer Service Area No. 4. The first phase of Stage III, gravity thickeners and sludge loadout facilities, has been designed and is awaiting construction funding. The remainder of Stage III is planned to include anaerobic digestion, dewatering and land application. The timing of implementing these facilities is uncertain.

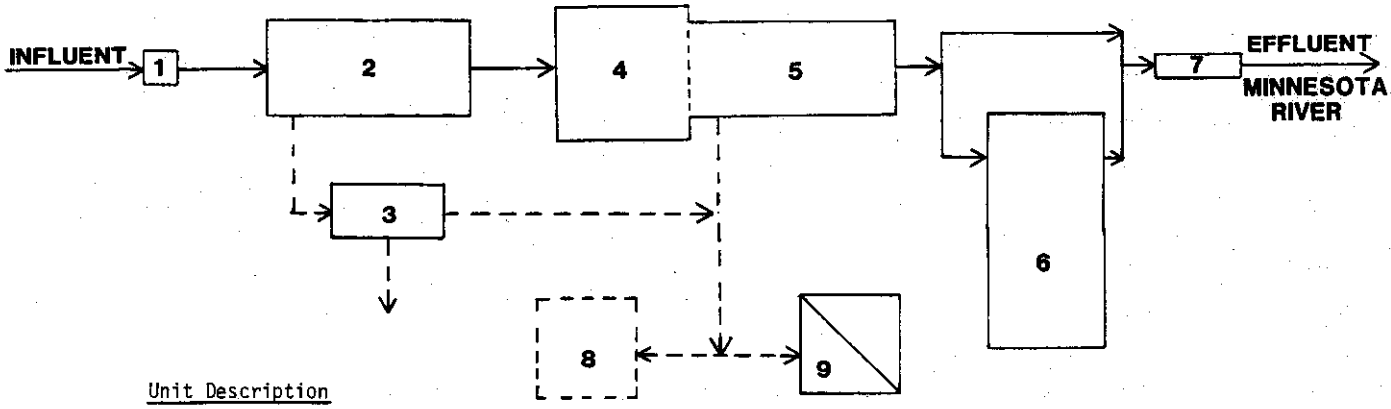
BLUE LAKE PLANT PROCESS UNIT LOADINGS
1982

Parameter	Annual Average	Maximum Month
Wastewater Flow, MGD	16.1	18.2
BOD Loading, lb/day	30,600	36,100
TSS Loading, lb/day	30,800	44,500
Primary Sedimentation[1]		
Surface Overflow Rate, gpd/Sq. Ft.	800	910
Weir Overflow Rate, gpd/Lin. Ft.	16,100	18,200
Aeration Tanks		
BOD Loading, lb/Day/1000 Cu. Ft.	82	91
Detention Time, hr.	3.3	2.9
Final Sedimentation		
Surface Overflow Rate, Sq. Ft.	620	710
Weir Overflow Rate, gpd/Lin. Ft.	12,000	14,000
Aerated Pond		
BOD Loading, lb/day	3,800	5,600
Detention Time, Days	3.2	2.9
Total Air Flow, cfm	12,400	14,700
Chlorine Use, lb/day	210	260
Thickened Sludge		
Production, lb/day	42,000	48,000
Volume, gpd	99,000	114,000
Concentration, %TSS	4.9	5.6
Volatile Solids, %	72	71

[1]Two clarifiers are used for combined settling and gravity sludge thickening. These clarifiers normally receive less flow than the other two clarifiers, but flow to each pair of clarifiers is not measured. Overflow rates shown are based on equal flow to all clarifiers.

BLUE LAKE WASTEWATER TREATMENT PLANT

FLOW DIAGRAM



Unit Description

Liquid Phase

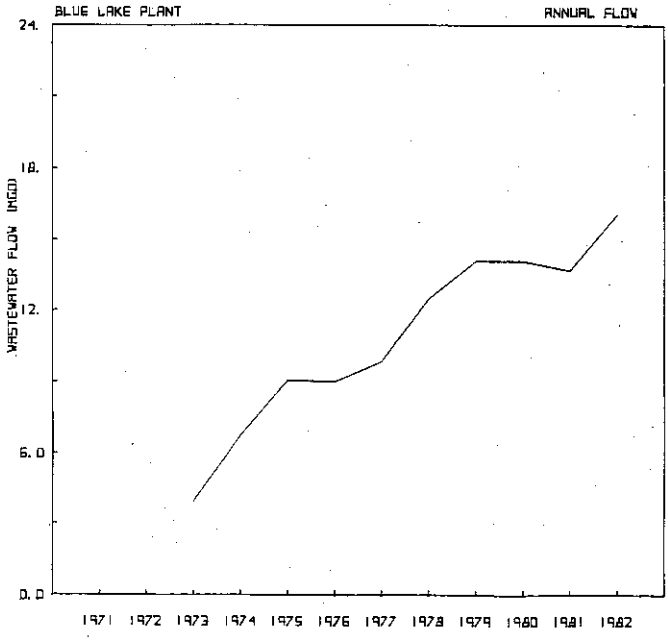
1. Screening
2. Primary Sedimentation
3. Grit Removal
4. Activated Sludge
5. Final Sedimentation
6. Aerated Effluent Pond
7. Chlorination

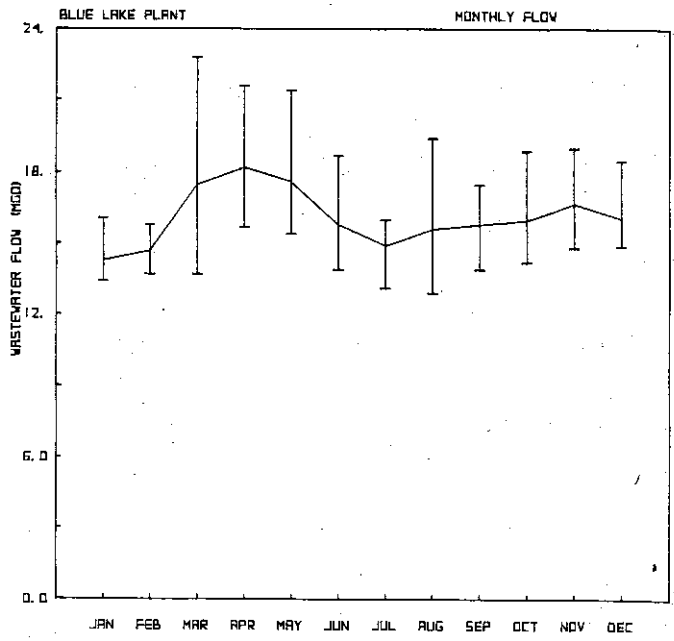
Solids Phase

8. Stage III (Future)
9. Disposal at Metro or Seneca Plant

Legend

- Liquid Flow
- Solids Transfer
- Existing Process Units
- Future Process Units



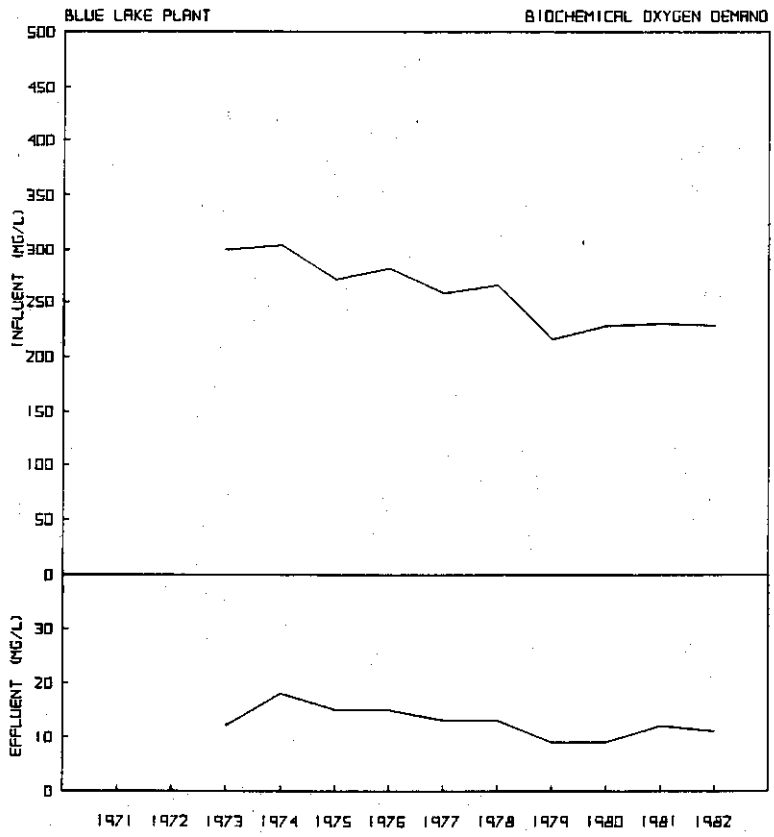


MONTHLY SUMMARY OF INFLUENT QUALITY
TREATMENT PLANT: Blue Lake

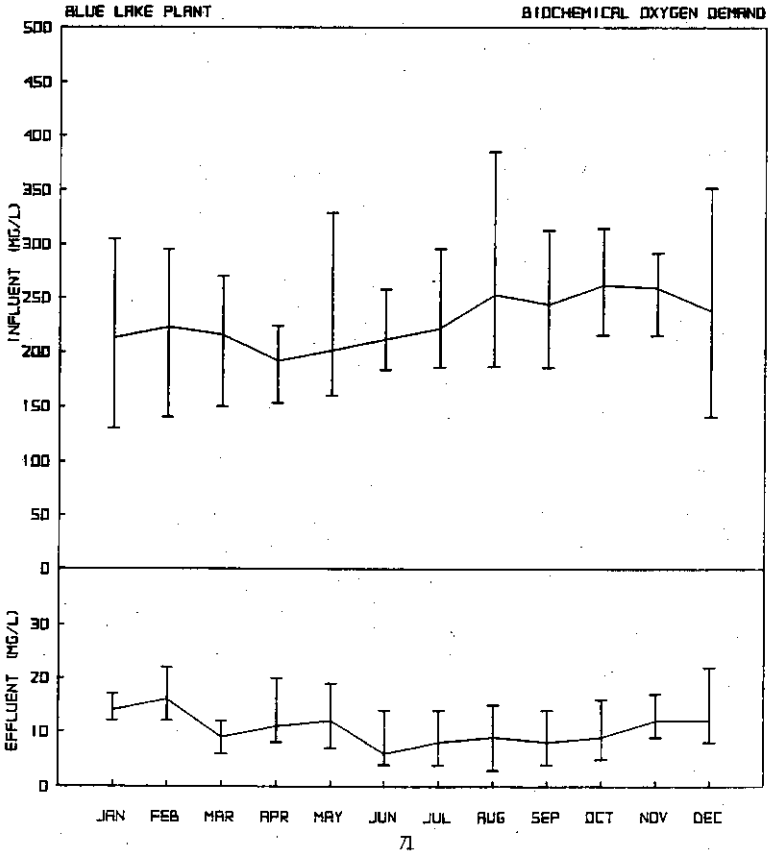
Month	Wastewater Flow, MGD	Temperature °C	TBOD mg/l	TSS mg/l	pH Range	KJN mg/l	Total-P mg/l	NH_3 mg/l	COD mg/l
JANUARY	14.3	12	213	180	6.6-8.0	39.2	8.7	18.9	462
FEBRUARY	14.7	12	223	186	6.8-7.6	34.0	6.8	17.6	460
MARCH	17.5	11	216	189	6.3-7.7	30.0	6.9	14.1	433
APRIL	18.2	11	192	161	6.9-7.6	26.2	5.6	12.1	400
MAY	17.6	12	202	202	6.7-7.8	28.2	6.5	12.6	426
JUNE	15.8	15	212	238	6.8-7.6	33.0	6.7	12.9	491
JULY	14.9	16	222	281	6.7-8.1	34.4	6.8	13.9	527
AUGUST	15.6	17	253	342	6.5-7.6	34.6	7.3	13.4	615
SEPTEMBER	15.8	17	244	255	6.8-7.5	35.8	7.6	13.4	530
OCTOBER	16.0	17	262	244	6.9-7.4	35.5	7.9	12.7	566
NOVEMBER	16.7	15	259	248	6.9-7.5	33.0	6.9	16.0	554
DECEMBER	16.1	14	238	241	7.0-7.4	33.8	6.7	18.0	531
1982 AVERAGE	16.1	14	228	230	6.3-8.1	33.1	7.0	14.6	500
1981 AVERAGE	13.7	14	230	241	5.6-9.4	----	----	----	508

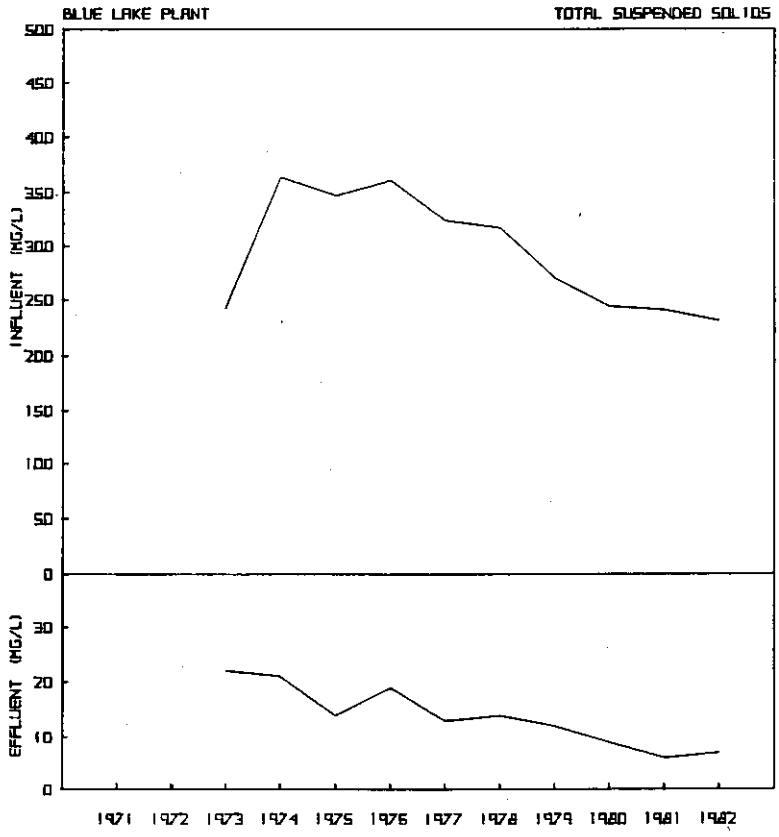
MONTHLY SUMMARY OF EFFLUENT QUALITY
TREATMENT PLANT: Blue Lake

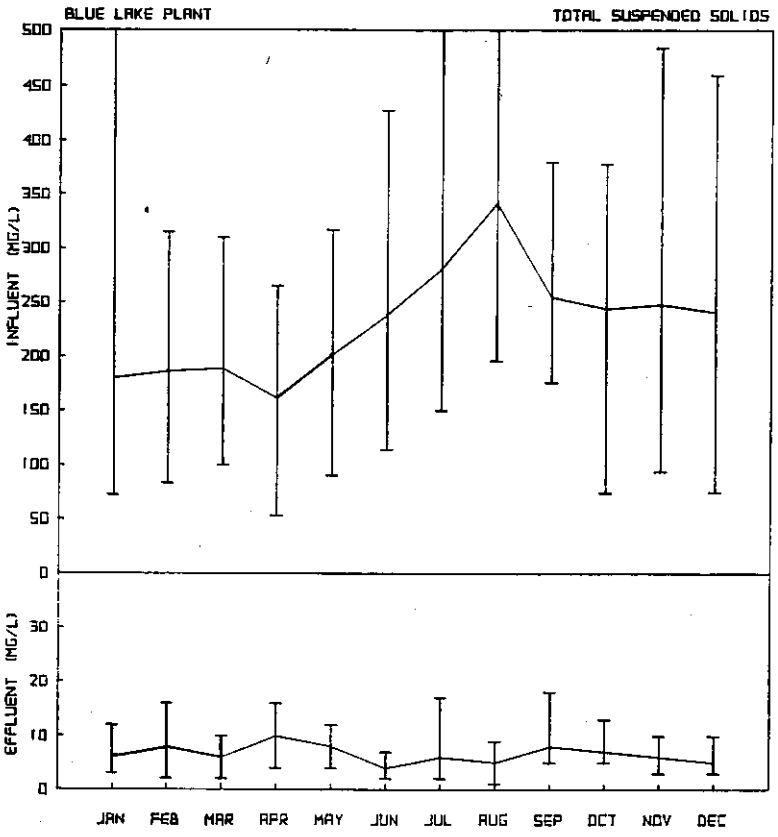
Month	TBOD mg/l	CBOD mg/l	COD mg/l	TSS mg/l	FECAL COLI Geo Mean no/100 ml	TURB NTU	KJN mg/l	NH_3 mg/l	NO_2 mg/l	NO_3 mg/l	Total P mg/l	C12 Used lbs	C12 Res mg/l	DO mg/l	pH Range	% Removal BOD	% Removal TSS
NPDES LIMIT	25	25	--	30	200	25	----	----	----	----	---	---	---	----	6.5-8.5	--	--
JANUARY	28	14	75	6	---	5	28.4	20.3	0.36	1.29	5.1	---	---	13.9	6.8-7.6	93	96
FEBRUARY	29	16	80	8	---	7	24.4	16.8	0.16	2.15	4.2	---	---	13.5	7.0-7.5	93	96
MARCH	10	9	73	6	10	6	20.0	13.5	0.05	0.12	3.5	200	0.6	12.6	7.0-7.8	96	97
APRIL	16	11	75	10	5	10	16.8	11.8	0.37	0.08	2.7	200	0.5	12.5	7.1-7.8	94	94
MAY	26	12	76	8	14	8	18.6	12.8	1.87	0.64	3.7	206	0.5	11.8	7.1-7.9	94	96
JUNE	19	6	71	4	8	6	20.2	13.3	1.25	0.11	3.6	205	0.7	11.2	7.0-7.6	97	98
JULY	21	8	72	6	4	7	20.9	13.1	3.48	0.10	3.3	201	0.7	9.2	7.1-8.4	96	98
AUGUST	27	9	73	5	7	6	18.3	11.6	2.10	1.96	3.7	200	0.7	9.5	7.1-7.7	96	99
SEPTEMBER	28	8	75	8	49	8	20.8	13.0	1.55	1.71	3.9	202	0.7	8.7	7.1-7.8	97	97
OCTOBER	38	9	73	7	28	7	26.5	10.6	1.62	1.10	4.8	256	0.7	8.8	7.1-7.6	97	97
NOVEMBER	17	12	69	6	---	6	19.4	14.2	0.69	1.01	3.5	---	---	11.6	7.1-7.6	95	97
DECEMBER	24	12	69	5	---	6	18.9	15.7	0.13	2.53	3.4	---	---	11.9	7.1-7.8	95	98
1982 AVG.	24	10	73	7	16	7	21.1	13.9	1.14	1.07	3.8	209	0.6	11.3	6.8-8.4	95	97
1981 AVG.	12	--	75	6	20	5	22.3	16.6	0.42	0.39	3.6	190	0.7	11.0	6.8-8.1	95	98

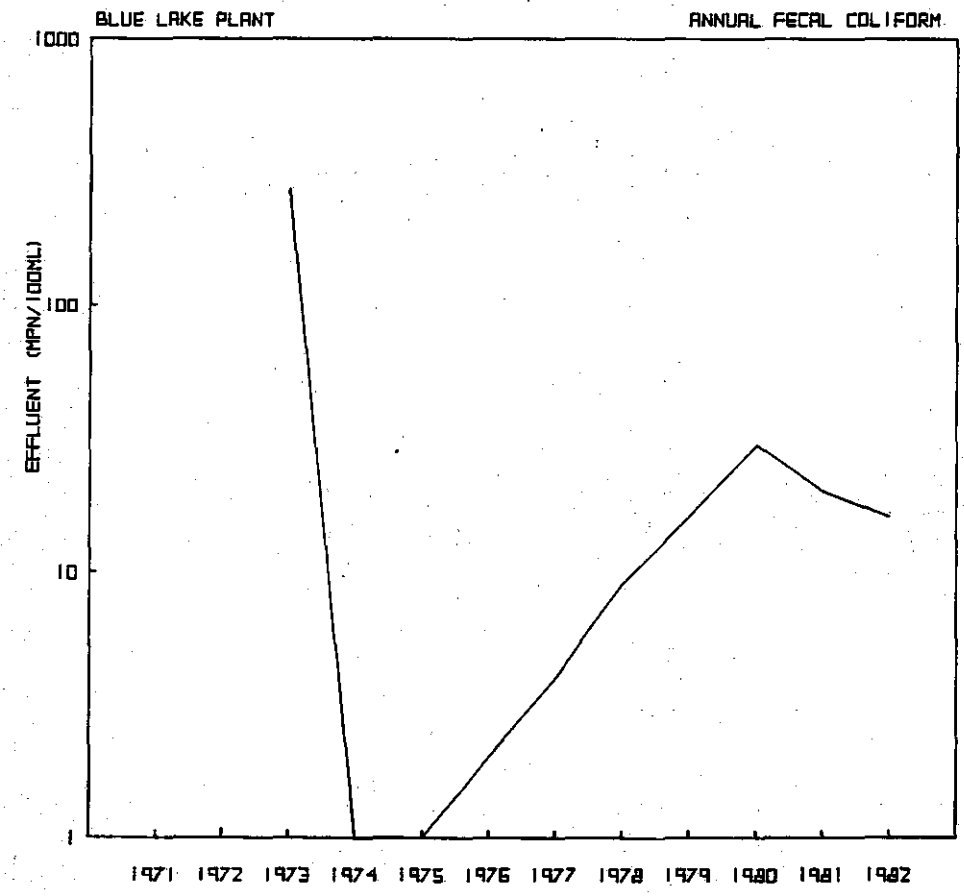


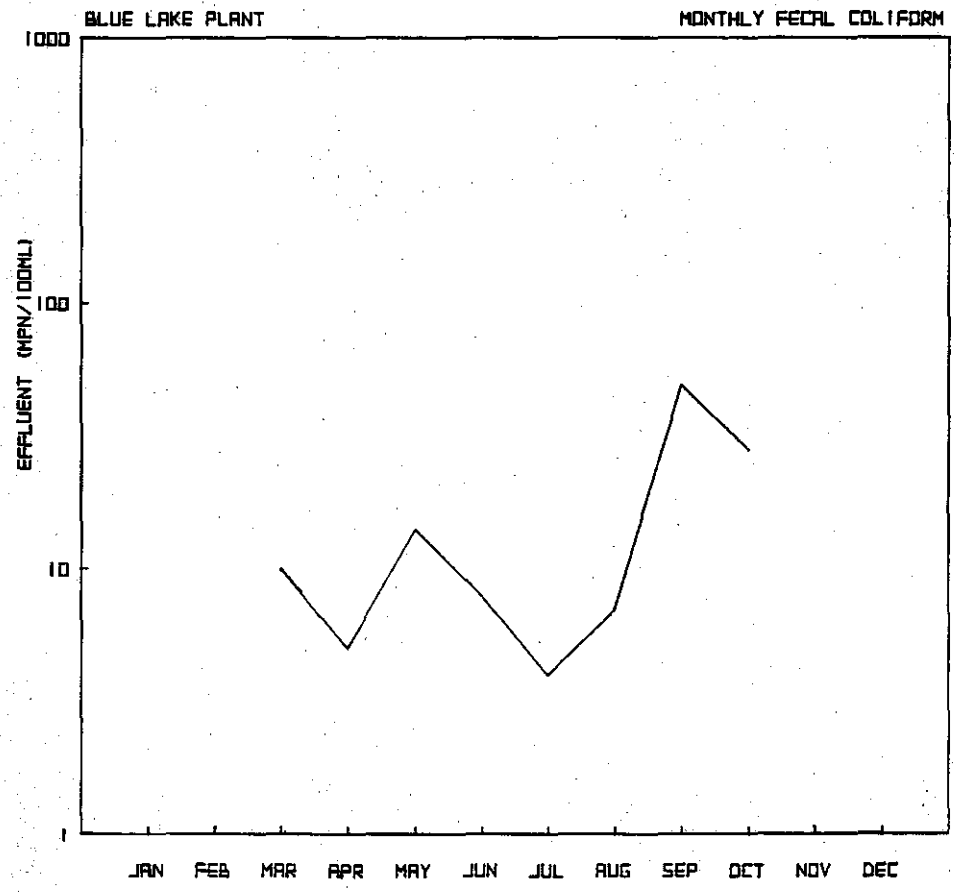
DATA REPRESENTS CBOD IN 1982. ALL PREVIOUS YEAR'S DATA ARE TBOD.

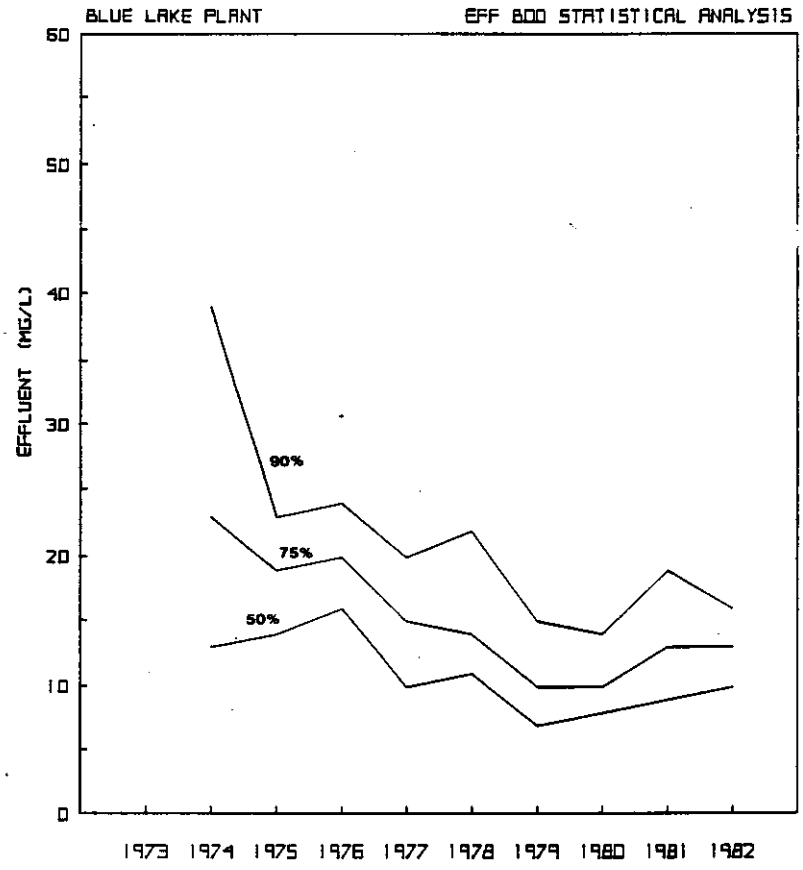


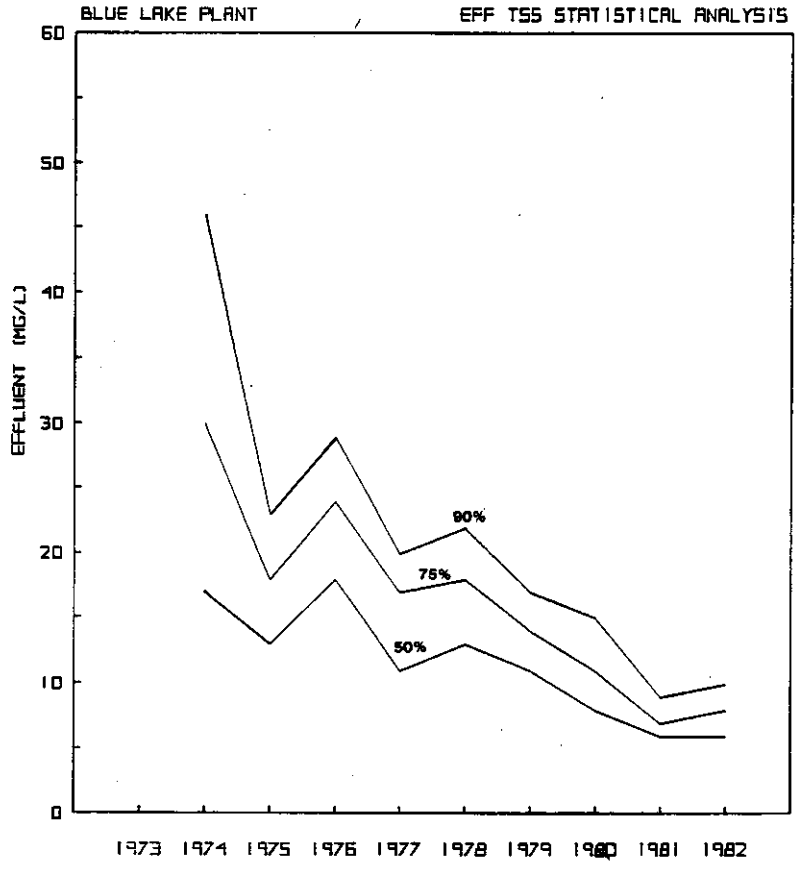

BLUE LAKE PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
EFFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
30
20
10
0
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982


BLUE LAKE PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
EFFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
30
20
10
0
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


BLUE LAKE PLANT
ANNUAL FECAL COLIFORM
1000
100
10
1
EFFLUENT (MPN/100ML)
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982


BLUE LAKE PLANT
MONTHLY FECAL COLIFORM
1000
100
10
1
EFFLUENT (MPN/100ML)
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


BLUE LAKE PLANT
EFF BOD STATISTICAL ANALYSIS
EFFLUENT (MG/L)
60
50
40
30
20
10
0
90%
75%
50%
1973 1974 1975 1976 1977 1978 1979 1980 1981 1982


BLUE LAKE PLANT
EFF TSS STATISTICAL ANALYSIS
EFFLUENT (MG/L)
60
50
40
30
20
10
0
90%
75%
50%
1973 1974 1975 1976 1977 1978 1979 1980 1981 1982

CHASKA WASTEWATER TREATMENT PLANT

Plant History and Description

The original Chaska Plant was designed by Lindsey Engineering Co. and constructed in 1963, with a design capacity of 0.75 mgd. The plant was converted to a pure oxygen activated sludge process in 1973, and final effluent filters were added in 1974. A plant expansion designed by McCombs-Knutson was constructed in 1980, increasing plant design capacity to 1.4 mgd. Actual operating capacity is somewhat less, due to high and widely variable organic loadings.

Liquid treatment consists of screening, grit removal, influent pumping, pure oxygen activated sludge aeration, final clarification, final effluent pumping, chlorination, and discharge to the Minnesota River.

Solids processing consists of aerobic digestion, and hauling to the Blue Lake Plant for further treatment and disposal.

The Chaska Plant is presently operating at about 60 percent of its rated hydraulic capacity and is subject to secondary treatment limits.

Performance

Plant flow averaged 0.80 mgd in 1982, up slightly from 0.70 mgd in 1981. Average plant effluent quality was 14 mg/L BOD and 11 mg/L TSS. Plant performance was affected by one NPDES weekly average effluent BOD violation, related to an excessively high influent organic loading. The probable source of the high organic loading was an industrial discharge. Statistical analysis of data show the following trend in effluent BOD and TSS from 1979 through 1982.

Effluent Concentration, mg/l

	50% of Time				75% of Time				90% of Time			
	1979	1980	1981	1982	1979	1980	1981	1982	1979	1980	1981	1982
BOD	93	14	14	12	160	22	24	16	210	38	34	22
TSS	43	11	13	10	83	15	16	14	130	18	22	19

Future

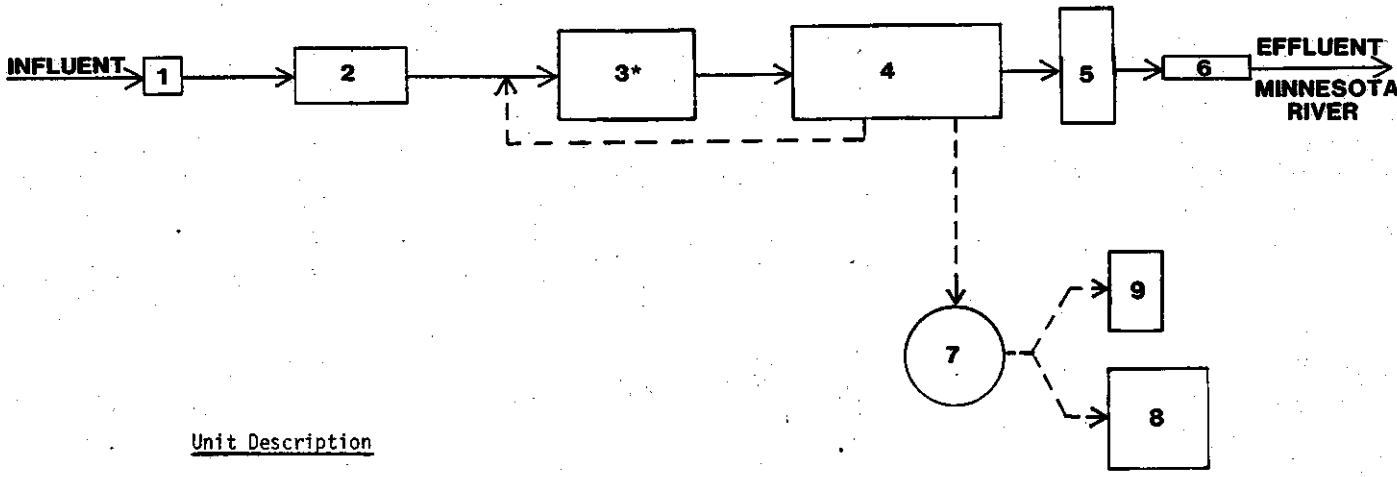
This plant is one of the Commission's permanent treatment plants. A plant expansion is scheduled for mid-1980's.

CHASKA PLANT PROCESS UNIT LOADINGS
1982

Parameter	Annual Average	Maximum Month
Wastewater Flow, MGD	0.80	1.06
BOD Loading, lb/day	1,260	1,490
TSS Loading, lb/day	1,120	1,520
COD Loading, lb/day	2,380	2,940
Sludge Production, lb/day	960	1,510
Grit Removal		
Overflow Rate, gpd/Sq. Ft.	17,780	23,560
Aeration Tanks		
Detention Time, Hr.	3.0	2.3
BOD Loading, lb/Day/1000 Cu. Ft.	93	110
Oxygen Utilization, lb/day as O_2	1,870	-----
Final Sedimentation		
Detention Time, Hr.	7.0	5.3
Weir Overflow Rate, gpd/Lin. Ft.	4,260	5,640
Surface Overflow Rate, gpd/Sq. Ft.	280	380
Chlorination		
Contact Time, Minutes	147	111
Chlorine Use, lb/day	29	33
Aerobic Digestion		
Solids Loading, lb/Cu. Ft./Day	0.025	-----
Detention Time, Days	53	36
Sludge Transport		
Volume, Gal./Day	7,220	10,650

CHASKA WASTEWATER TREATMENT PLANT

FLOW DIAGRAM



Unit Description

Liquid Phase

1. Screening
2. Grit Removal
3. Activated Sludge
4. Final Sedimentation
5. Effluent Filtration
6. Chlorination

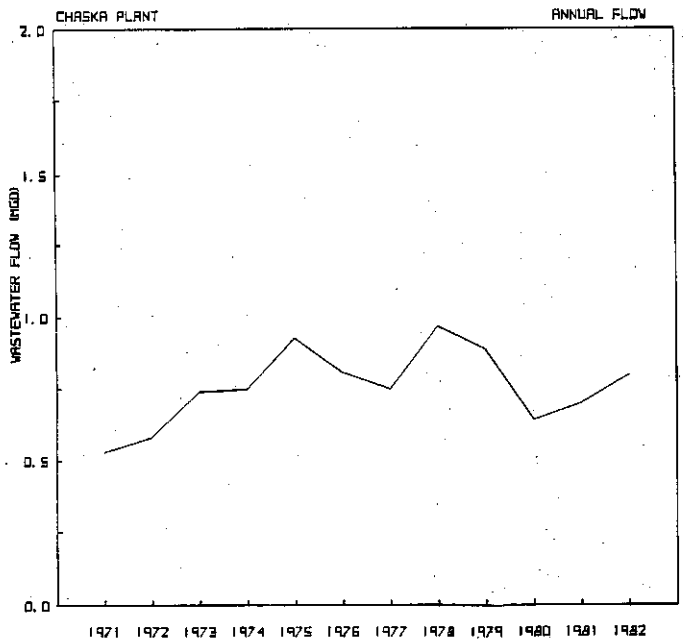
Solids Phase

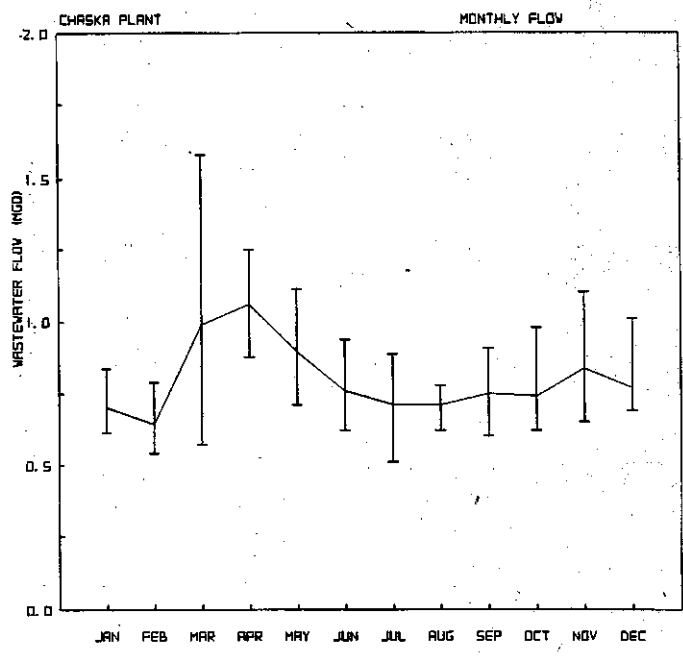
7. Two Stage Aerobic Digestion
8. Land Spread
9. Haul to Blue Lake System

* Pure Oxygen

Legend

- Liquid Flow
- Solids Transfer
- Existing Process Units
- Future Process Units



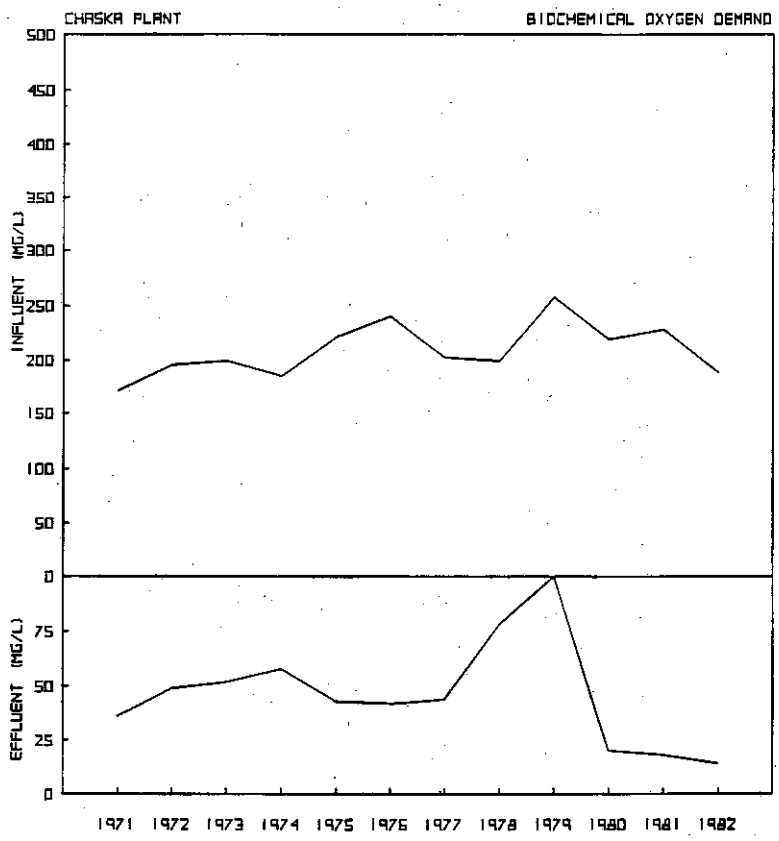


MONTHLY SUMMARY OF INFLUENT QUALITY
TREATMENT PLANT: Chaska

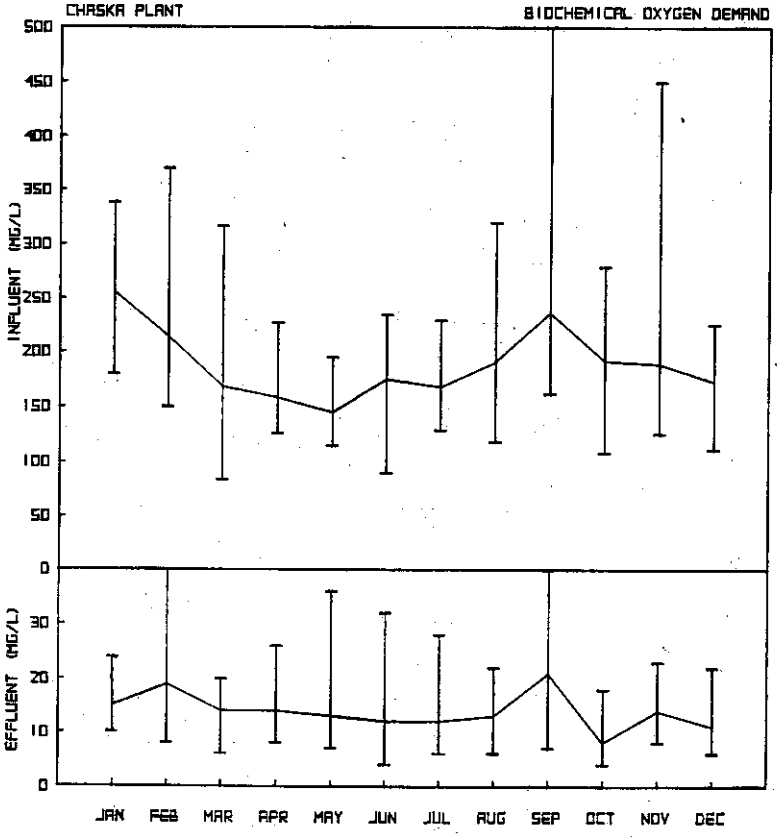
Month	Wastewater Flow, MGD	Temperature °C	TBOD mg/l	TSS mg/l	pH Range	KJN mg/l	Total-P mg/l	NH_3 mg/l	COD mg/l
JANUARY	0.70	11	256	260	7.2-10.0	52.5	7.4	25.3	503
FEBRUARY	0.64	10	214	194	7.0-11.2	46.4	7.3	20.5	443
MARCH	0.99	9	168	135	6.6-9.3	22.6	4.2	14.4	309
APRIL	1.06	10	158	120	6.0-9.2	23.2	4.0	12.5	276
MAY	0.90	12	145	153	5.6-9.0	28.7	6.3	13.4	295
JUNE	0.76	14	175	182	7.0-9.0	29.2	5.5	13.8	377
JULY	0.71	16	168	145	6.8-8.8	29.6	5.0	14.6	344
AUGUST	0.71	18	191	161	6.7-10.1	31.4	5.9	13.8	343
SEPTEMBER	0.75	18	237	165	6.0-8.90	34.5	6.4	13.5	390
OCTOBER	0.74	17	192	168	5.6-10.0	29.9	5.2	13.2	322
NOVEMBER	0.84	15	189	176	5.8-10.8	32.0	5.3	17.7	351
DECEMBER	0.77	13	173	146	6.5-9.2	32.7	5.2	19.2	319
1982 AVERAGE	0.80	14	189	167	5.6-11.2	32.7	5.6	16.0	356
1981 AVERAGE	0.70	14	229	189	4.6-12.0	----	---	----	428

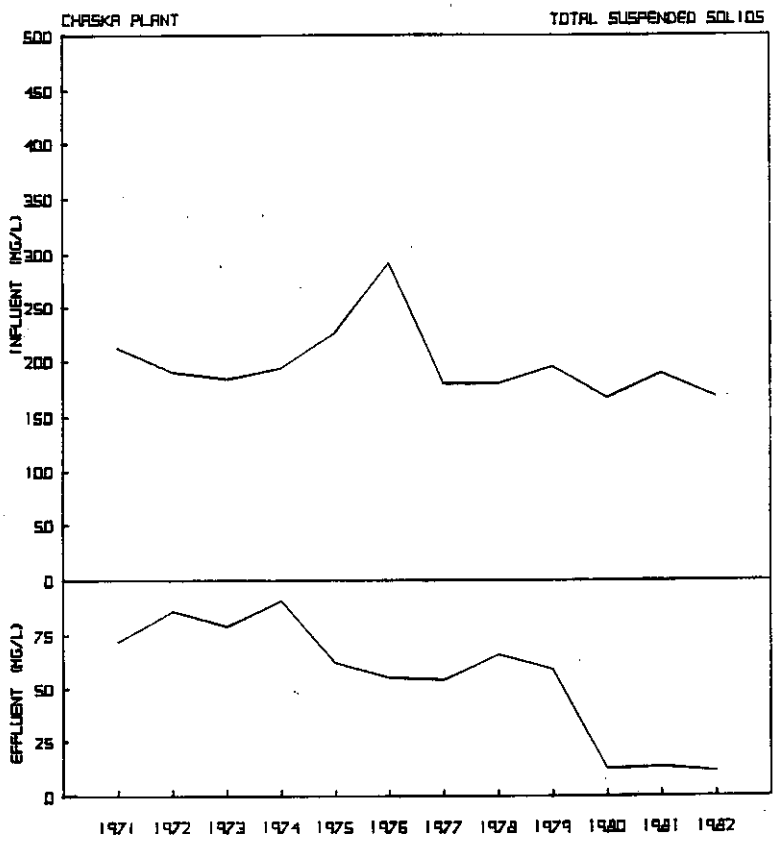
MONTHLY SUMMARY OF EFFLUENT QUALITY
TREATMENT PLANT: Chaska

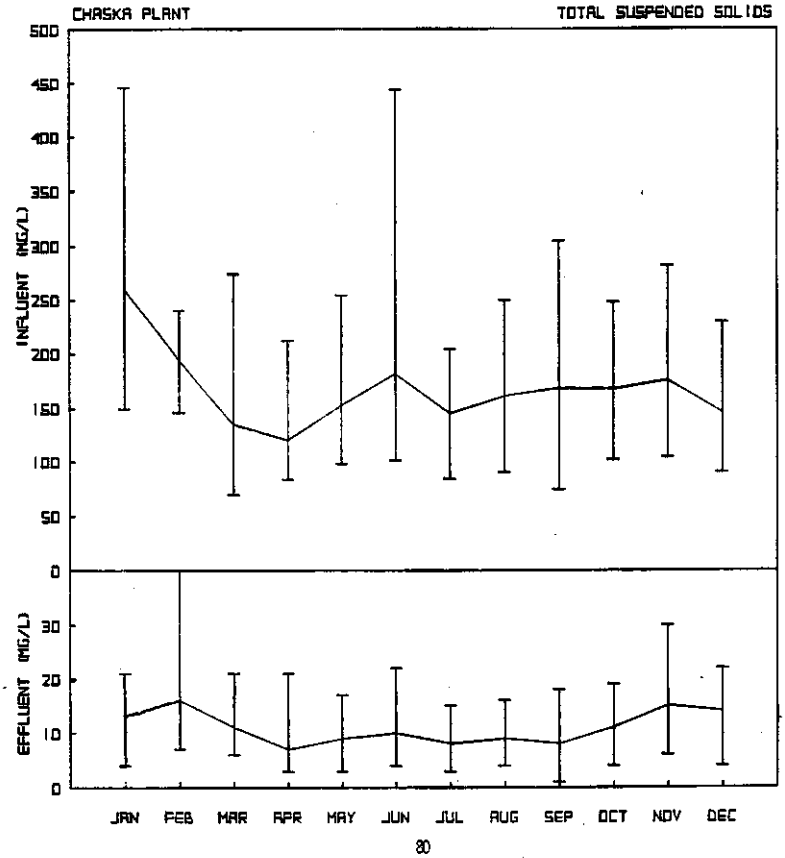
Month	TBOD mg/l	CBOD mg/l	COD mg/l	TSS mg/l	FECAL COLI Geo Mean no/100 ml	TURB NTU	KJN mg/l	NH_3 mg/l	NO_2 mg/l	NO_3 mg/l	Total P mg/l	Cl2 Used lbs	Cl2 Res mg/l	DO mg/l	pH Range	% Removal BOD	% Removal TSS
NPDES LIMIT	25	25	--	30	200	25	-----	---	----	---	---	--	---	-----	6.5-8.5	--	--
JANUARY	21	15	89	13	---	5	18.6	12.5	0.54	0.55	2.2	--	---	10.7	6.8-7.7	94	95
FEBRUARY	25	19	97	16	---	6	21.0	13.0	0.59	1.74	2.0	--	---	9.3	7.1-7.7	91	92
MARCH	18	14	81	11	2	6	14.8	10.2	1.08	0.74	1.7	30	2.2	10.0	7.0-7.7	92	92
APRIL	14	14	72	7	2	5	13.6	9.2	0.69	0.71	1.2	32	2.4	10.6	7.1-7.7	91	94
MAY	17	13	71	9	7	7	13.6	10.2	0.68	0.54	1.9	29	2.2	10.1	6.9-7.8	91	94
JUNE	16	12	83	10	2	5	17.3	9.9	0.97	0.46	2.4	27	2.0	9.6	7.0-7.7	93	95
JULY	18	12	73	8	5	5	16.5	8.9	1.52	0.68	0.8	25	1.7	8.5	7.2-8.2	93	95
AUGUST	19	13	70	9	3	5	14.1	7.5	1.56	0.80	1.2	27	1.8	7.5	7.2-7.8	93	94
SEPTEMBER	27	21	78	8	14	5	15.8	7.2	2.13	1.16	2.2	33	2.0	7.4	7.1-7.6	91	95
OCTOBER	21	8	57	11	2	4	14.4	7.6	1.93	1.81	1.7	28	2.0	8.3	7.1-7.6	96	94
NOVEMBER	25	14	64	15	---	5	13.6	8.6	2.06	1.81	1.2	--	---	7.6	7.0-7.8	93	92
DECEMBER	22	11	64	14	---	5	14.5	10.9	1.55	2.14	1.4	--	---	8.9	7.1-7.6	94	91
1982 AVG.	20	14	75	11	5	5	15.6	9.6	1.27	1.10	1.7	29	2.0	9.0	6.8-8.2	93	93
1981 AVG.	18	--	79	13	7	5	16.0	9.5	1.32	0.26	1.3	32	2.7	8.6	6.6-8.1	92	93

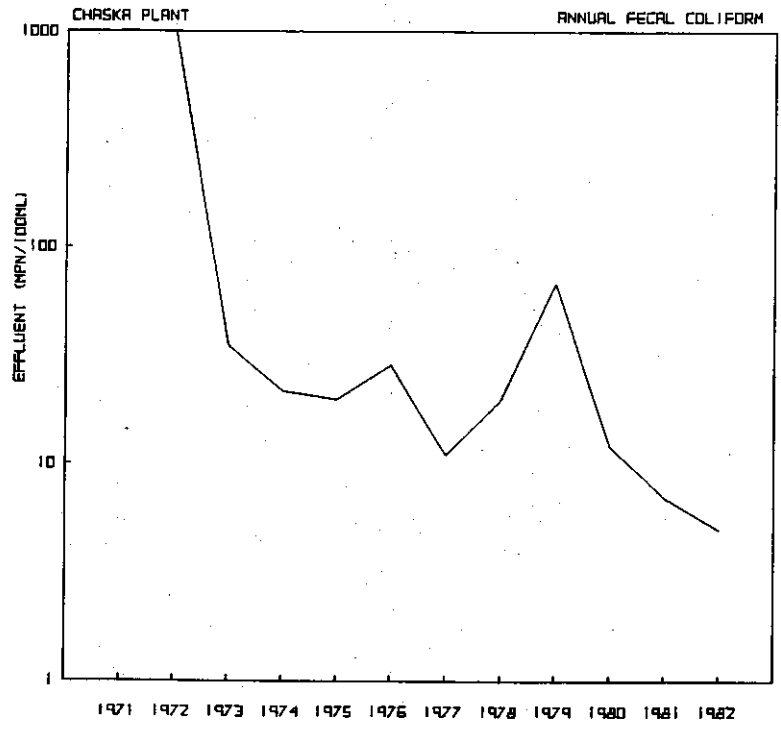


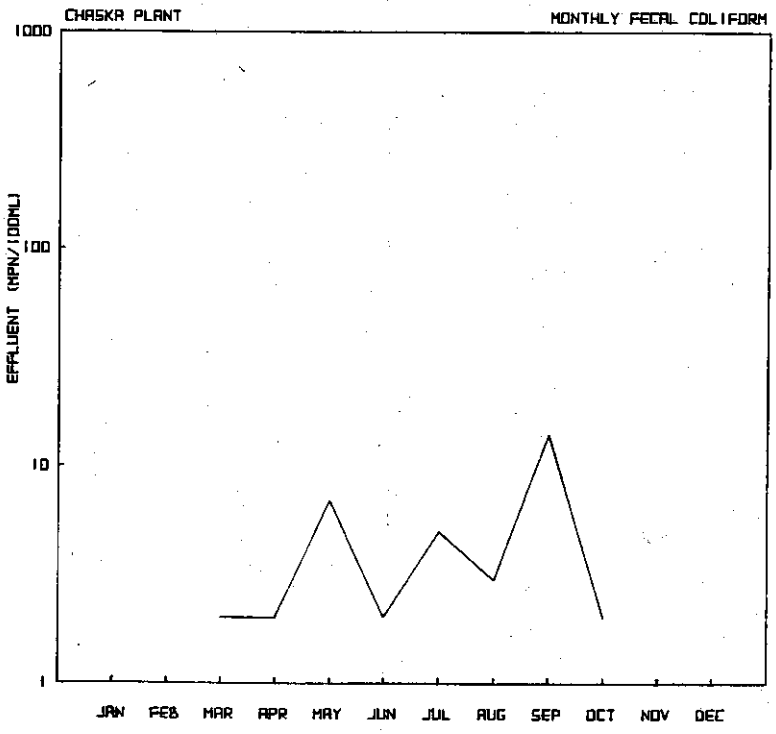
DATA REPRESENTS CBOD IN 1982. ALL PREVIOUS YEAR'S DATA ARE TBOD.

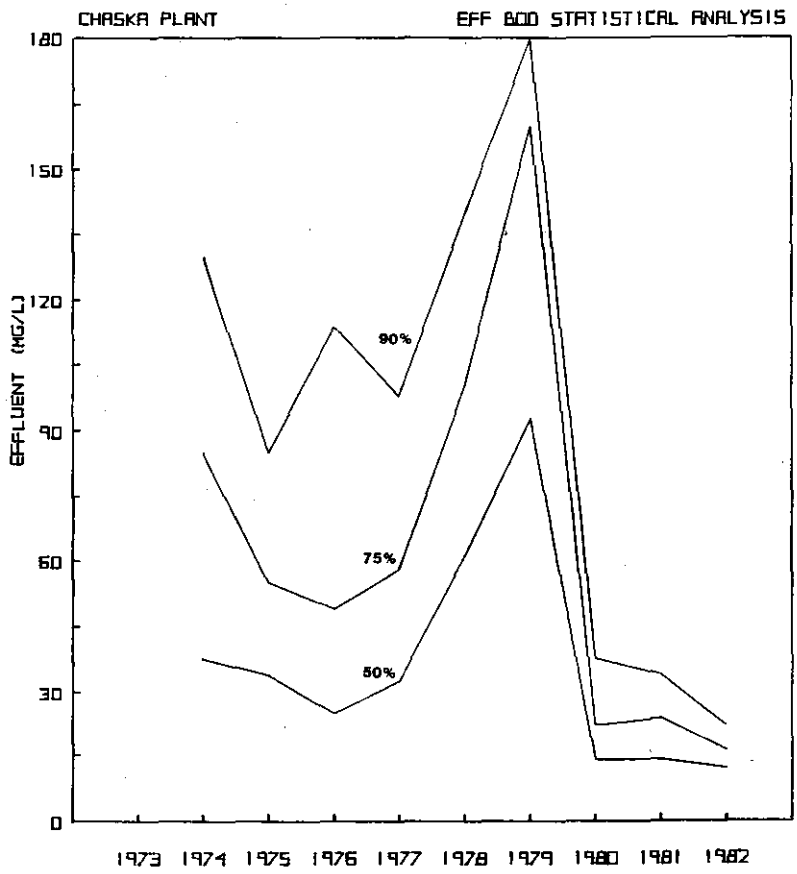


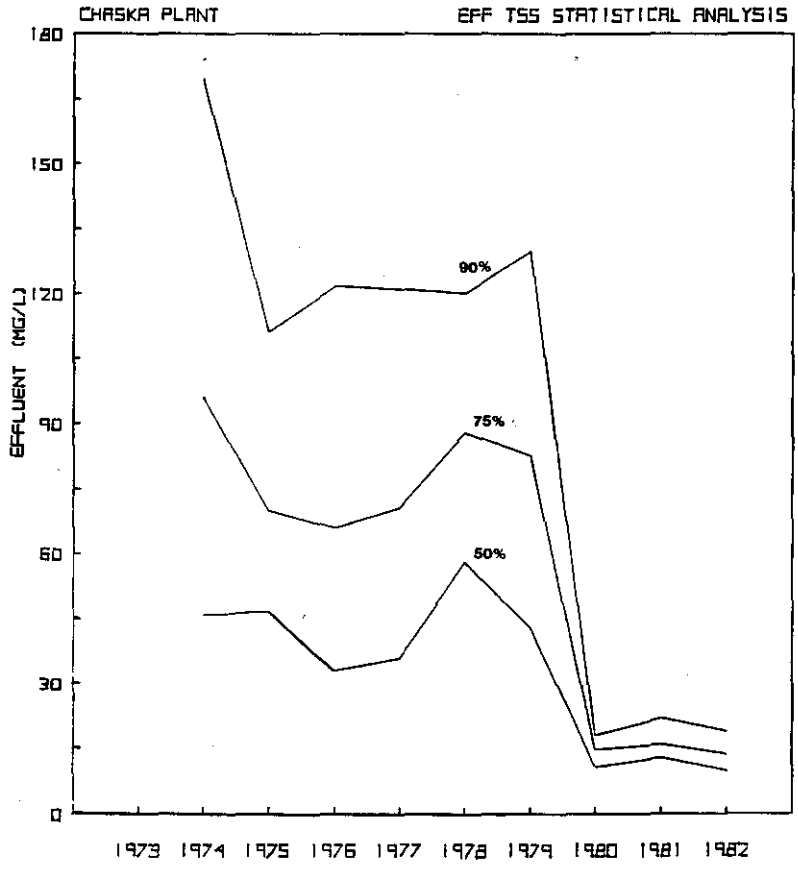

CHASKA PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
EFFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
75
50
25
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982


CHASKA PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
EFFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
30
20
10
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


CHASKA PLANT
ANNUAL FECAL COLIFORM
EFFLUENT (MPN/100ML)
1000
100
10
1
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982


CHASKA PLANT
MONTHLY FECAL COLIFORM
EFFLUENT (MPN/100ML)
1000
100
10
1
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


CHASKA PLANT
EFF BOD STATISTICAL ANALYSIS
EFFLUENT (MG/L)
180
150
120
90
60
30
0
90%
75%
50%
1973 1974 1975 1976 1977 1978 1979 1980 1981 1982


CHASKA PLANT
EFF TSS STATISTICAL ANALYSIS
EFFLUENT (MG/L)
180
150
120
90
60
30
0
90%
75%
50%
1973 1974 1975 1976 1977 1978 1979 1980 1981 1982

COTTAGE GROVE WASTEWATER TREATMENT PLANT

Plant History and Description

The Cottage Grove Plant was designed by Bonestroo, Rosene, Arnderlik, and Associates, originally constructed in 1962 and expanded in 1963 and 1968. In 1975, effluent polishing filters were added to the plant. In 1976, primary anaerobic digester volume was increased and a new cover was installed. In 1979, the plant was expanded to its current design capacity of 1.8 mgd.

Liquid treatment consists of screening, primary sedimentation, activated sludge aeration, final clarification, effluent polishing filters, chlorination, and discharge to the Mississippi River.

Solids processing consists of combined sludge gravity thickening, anaerobic digestion with ultimate disposal by landspreading or the Metropolitan Plant Interceptor System.

The plant is presently operating at about 70 percent of its design capacity and is subject to secondary treatment limits.

Performance

The plant flow averaged 1.26 mgd in 1982, up slightly from 1.21 mgd in 1981. Average plant effluent quality was 10 mg/L BOD and 7 mg/L TSS. Plant performance was good throughout the year although one NPDES Permit violation occurred in June. The violation, exceeding the weekly effluent fecal coliform limit, was the result of nitrification (nitrite ion) interfering with chlorination. Statistical analysis of data show the following trend in effluent BOD and TSS from 1979 through 1982.

Effluent Concentration, mg/l

	50% of Time				75% of Time				90% of Time			
	1979	1980	1981	1982	1979	1980	1981	1982	1979	1980	1981	1982
BOD	12	10	9	8	20	14	15	13	50	18	20	18
TSS	10	7	5	6	16	13	8	10	28	22	14	14

Future

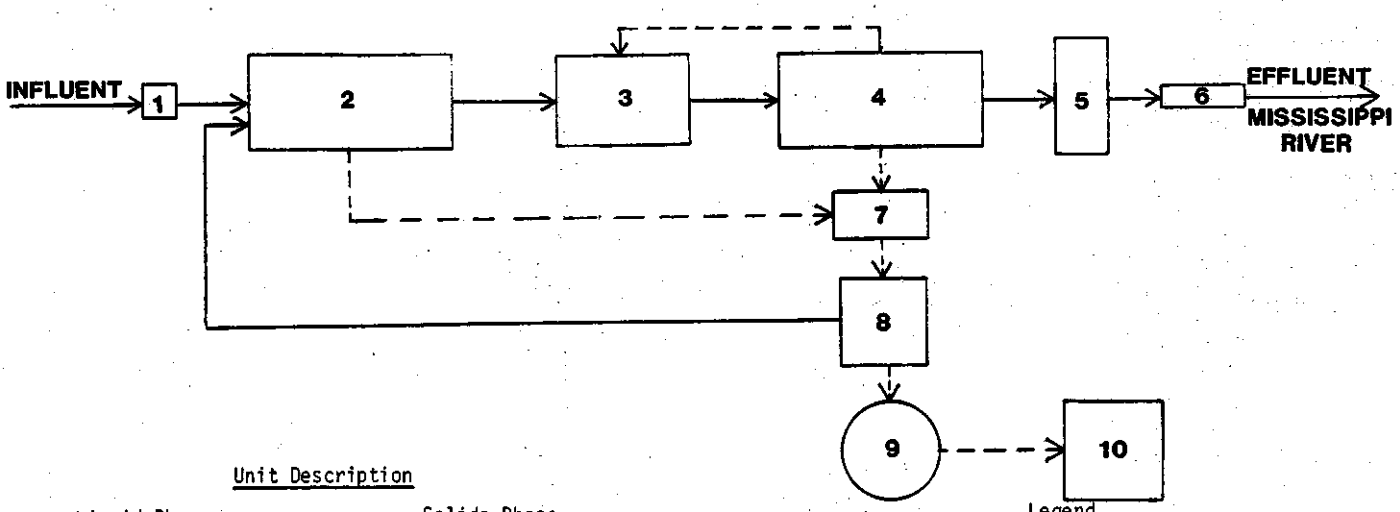
The Cottage Grove facility is considered a permanent plant. The plant is expected to be expanded in the late 1980's.

COTTAGE GROVE PLANT PROCESS UNIT LOADINGS
1982

Parameter	Annual Average	Maximum Month
Wastewater Flow, MGD	1.26	1.32
BOD Loading, lb/day	2,186	2,528
TSS Loading, lb/day	1,829	2,245
COD Loading, lb/day	4,174	-----
Primary Sedimentation		
Detention Time, hour-North	2.5	2.4
Detention Time, hour-South	3.8	3.6
Weir Overflow Rate, gpd/Lin. Ft.-North	6,680	7,000
Weir Overflow Rate, gpd/Lin. Ft.-South	4,320	4,520
Surface Overflow Rate, gpd/Sq. Ft.-North	530	550
Surface Overflow Rate, gpd/Sq. Ft.-South	530	550
Aeration Basin		
BOD Loading, lb/Day/1000 Cu. Ft.	43	50
Final Sedimentation		
Detention Time, hour	2.7	2.6
Weir Overflow Rate, gpd/Lin. Ft.	4,470	4,680
Surface Overflow Rate, gpd/Sq. Ft.	396	415
Polishing Filtration		
Average Filtration Rate, gpm/Sq. Ft.	2.9	3.1
Chlorination		
Contact Time, Minutes	34	32
Chlorine Use, lb/day	86	108
Gravity Thickener		
Surface Loading Rate, gpd/Sq. Ft.	730	---
Mass Loading Rate, lb/Sq. Ft./day	6	---
Anaerobic Digestion		
Solid Retention Time, day	48	39
Sludge Transport		
Volume, gpd	9,528	13,000
Mass, lb/day	1,295	1,890

COTTAGE GROVE WASTEWATER TREATMENT PLANT

FLOW DIAGRAM



Unit Description

Liquid Phase

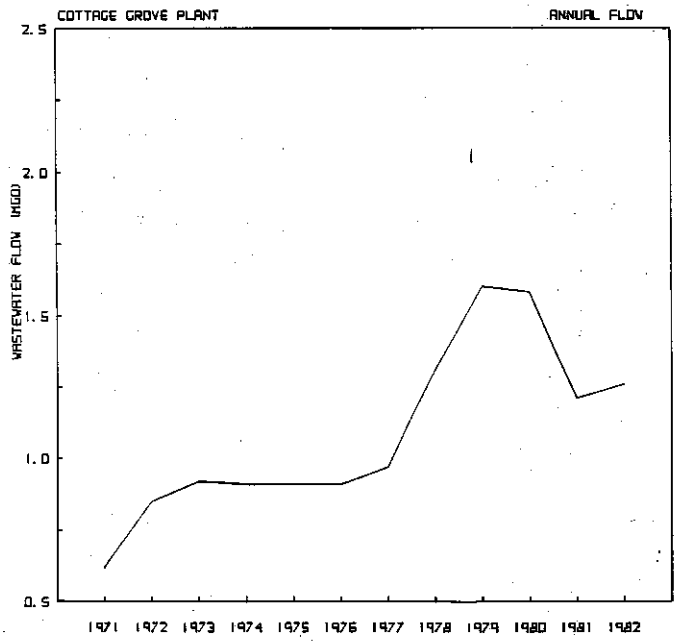
1. Screening
2. Primary Sedimentation
3. Activated Sludge
4. Final Sedimentation
5. Effluent Filtration
6. Chlorination

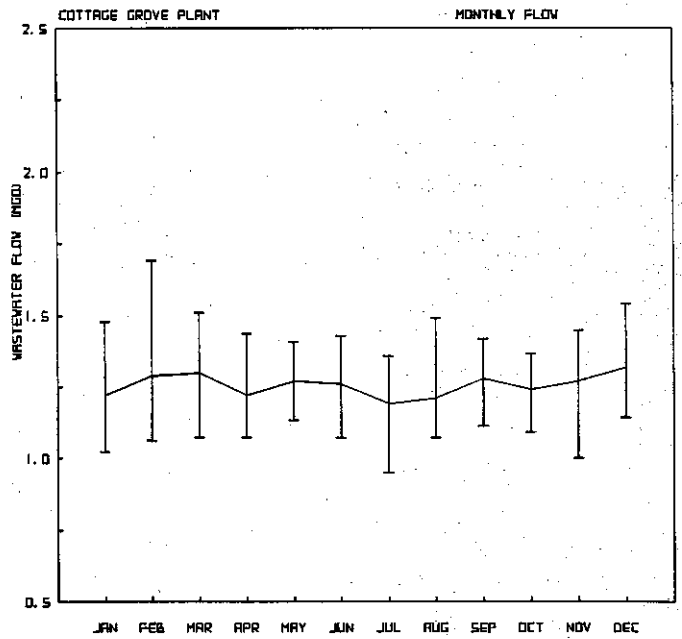
Solids Phase

7. Sludge Blend Tank
8. Sludge Thickener
9. Anaerobic Digestion
10. Haul to Land Spreading

Legend

- Liquid Flow
- Solids Transfer
- Existing Process Units
- Future Process Units



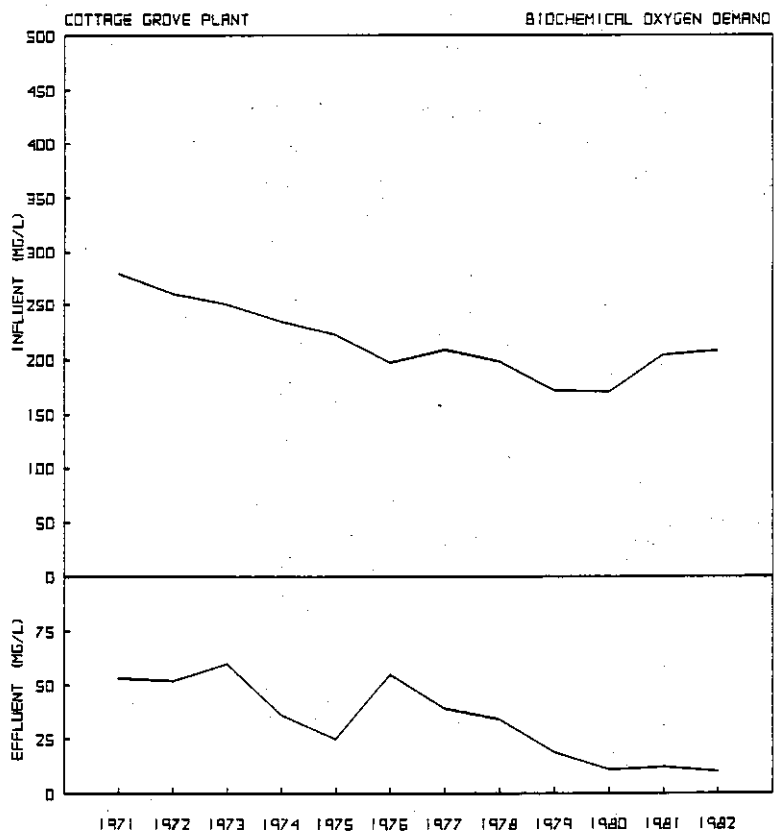


MONTHLY SUMMARY OF INFLUENT QUALITY
TREATMENT PLANT: Cottage Grove

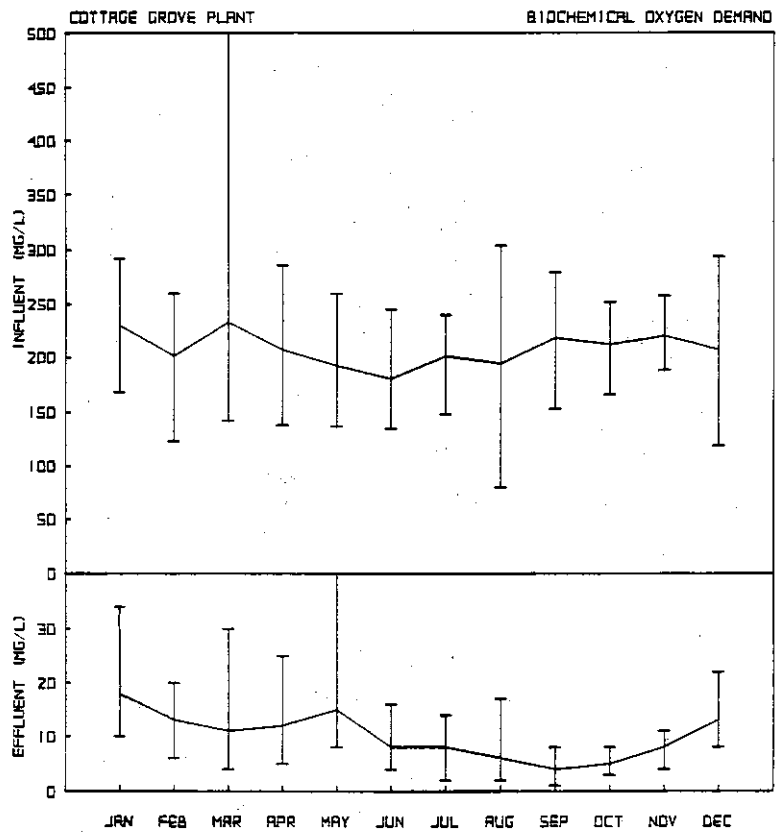
Month	Wastewater Flow, MGD	Temperature °C	TBOD mg/l	TSS mg/l	pH Range	KJN mg/l	Total-P mg/l	NH_3 mg/l	COD mg/l
JANUARY	1.22	11	230	202	7.4-8.5	54.0	9.0	31.9	441
FEBRUARY	1.29	11	201	171	7.7-8.7	53.0	7.6	26.3	403
MARCH	1.30	11	233	207	7.8-8.6	37.6	7.3	26.7	456
APRIL	1.22	11	207	184	7.4-8.5	40.4	6.9	26.1	413
MAY	1.27	14	192	150	7.4-8.3	42.1	7.3	25.8	349
JUNE	1.26	17	180	185	7.2-8.4	51.8	8.5	24.7	378
JULY	1.19	18	201	153	7.4-8.1	44.6	7.4	24.2	377
AUGUST	1.21	20	194	166	7.4-8.1	41.3	7.3	23.1	356
SEPTEMBER	1.28	20	218	170	7.4-8.2	50.5	8.2	26.3	422
OCTOBER	1.24	19	212	172	7.3-8.1	45.9	6.8	23.8	392
NOVEMBER	1.27	16	220	155	7.3-8.2	46.1	7.8	28.8	381
DECEMBER	1.32	14	207	164	7.6-8.3	45.8	7.2	30.6	400
1982 AVERAGE	1.26	15	208	173	7.2-8.7	46.1	7.6	26.5	397
1981 AVERAGE	1.21	16	204	187	7.2-8.6	----	---	----	399

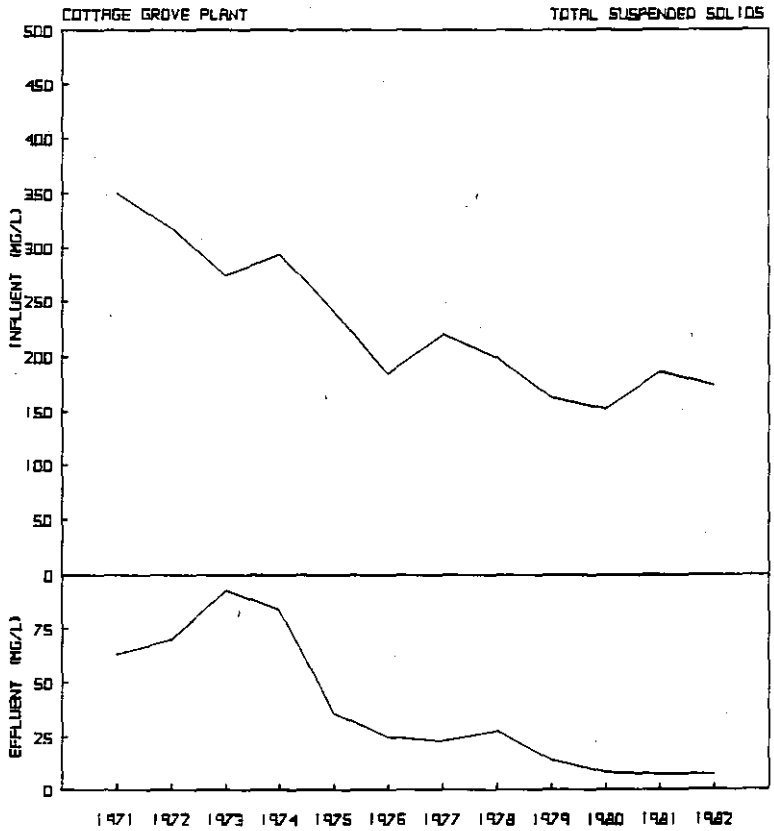
MONTHLY SUMMARY OF EFFLUENT QUALITY
TREATMENT PLANT: Cottage Grove

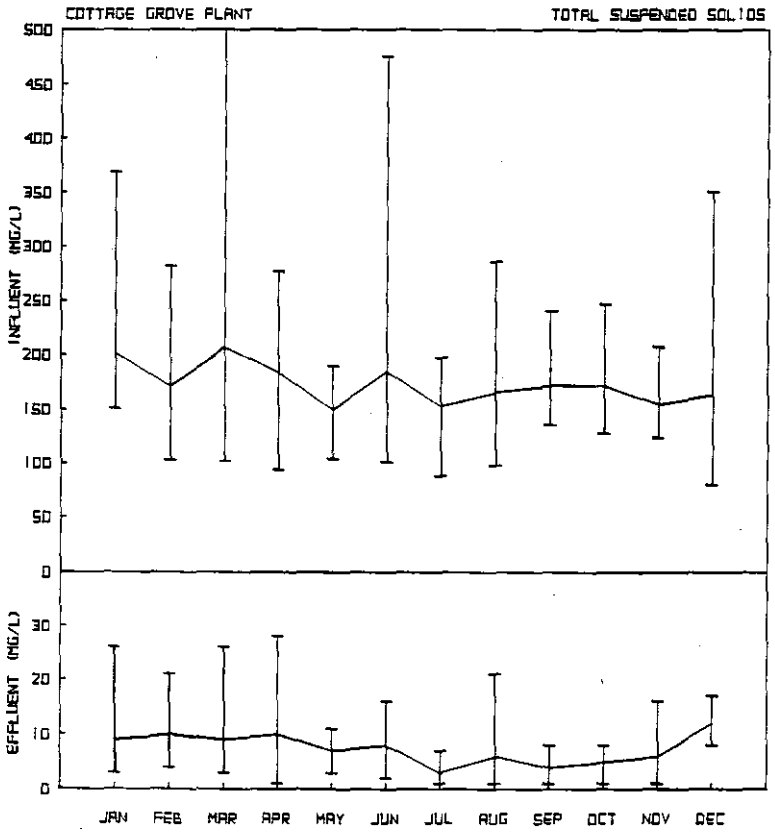
Month	TBOD mg/l	CBOD mg/l	COD mg/l	TSS mg/l	FECAL COLI Geo Mean no/100 ml	TURB NTU	KJN mg/l	NH_3 mg/l	NO_2 mg/l	NO_3 mg/l	Total P mg/l	Cl2 Used lbs	Cl2 Res mg/l	DO mg/l	pH Range	% Removal BOD	% Removal TSS
NPDES LIMIT	25	25	--	30	200	25	----	----	----	------	---	---	----	---	6.5-8.5	--	--
JANUARY	22	18	69	9	---	5	21.9	14.3	1.25	14.66	5.4	---	----	6.2	7.1-7.7	92	96
FEBRUARY	17	13	71	10	---	6	34.8	26.8	0.48	3.43	5.6	---	----	7.1	7.3-7.8	94	94
MARCH	11	11	80	9	2	8	34.9	28.8	0.59	0.45	5.4	99	6.6	6.6	7.2-7.9	95	95
APRIL	13	12	82	10	12	7	34.3	26.8	2.18	0.08	5.2	74	5.0	6.5	7.1-7.6	94	95
MAY	18	15	63	7	29	4	21.5	15.5	9.93	1.58	5.5	72	4.8	6.4	6.7-7.5	92	96
JUNE	12	8	65	8	13	5	8.2	3.2	4.89	15.11	4.7	108	4.8	6.2	7.0-7.3	96	96
JULY	10	8	39	3	11	4	3.4	0.3	0.41	18.88	5.0	106	5.2	5.7	7.1-7.6	96	98
AUGUST	9	6	41	6	8	4	2.4	0.2	0.01	22.90	5.4	99	12.1	6.3	6.9-7.4	97	96
SEPTEMBER	4	4	33	4	3	2	3.0	0.1	0.02	24.74	5.5	96	10.7	5.9	7.0-7.3	98	98
OCTOBER	6	5	41	5	11	2	2.4	0.4	0.02	24.61	5.3	93	8.5	5.7	6.9-7.3	98	97
NOVEMBER	16	8	48	6	---	2	7.5	2.6	2.44	16.76	5.1	---	----	5.3	7.1-7.4	97	96
DECEMBER	37	13	58	12	---	4	24.8	16.6	1.80	6.14	5.2	---	----	4.8	7.2-7.7	94	93
1982 AVG.	14	10	57	7	11	4	16.6	11.3	2.00	12.44	5.3	93	7.2	6.1	6.7-7.9	95	96
1981 AVG.	12	--	47	7	55	5	8.4	9.5	1.25	18.88	5.0	102	5.2	5.9	6.7-8.3	94	96

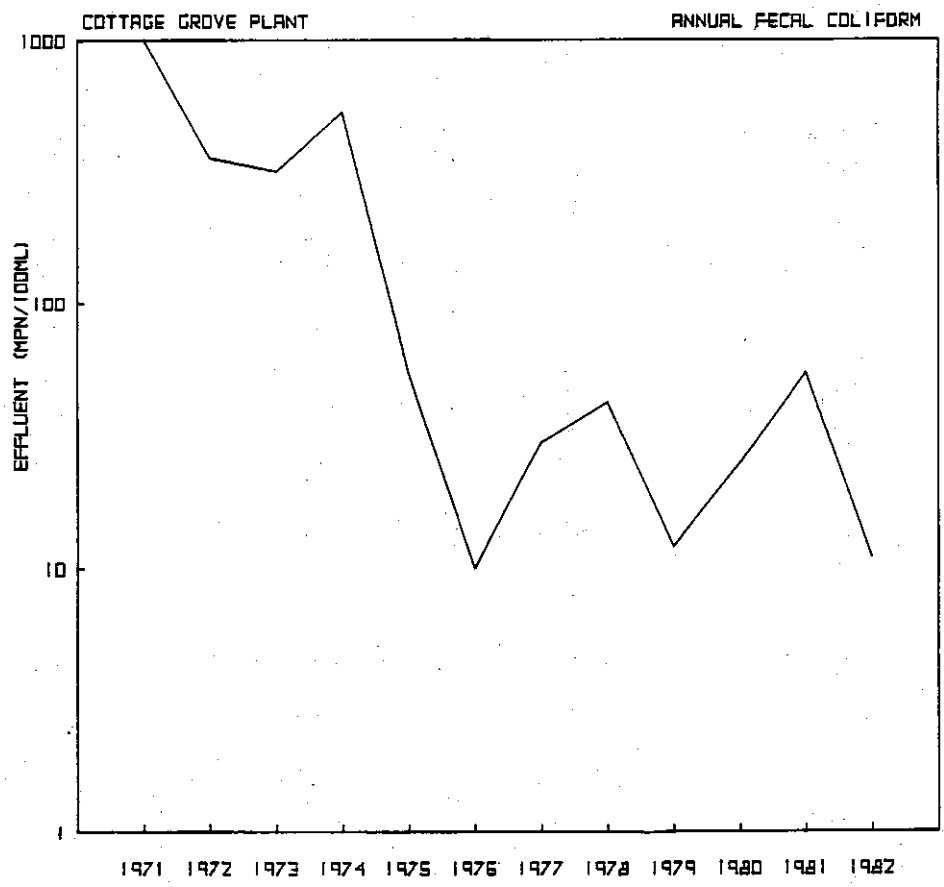


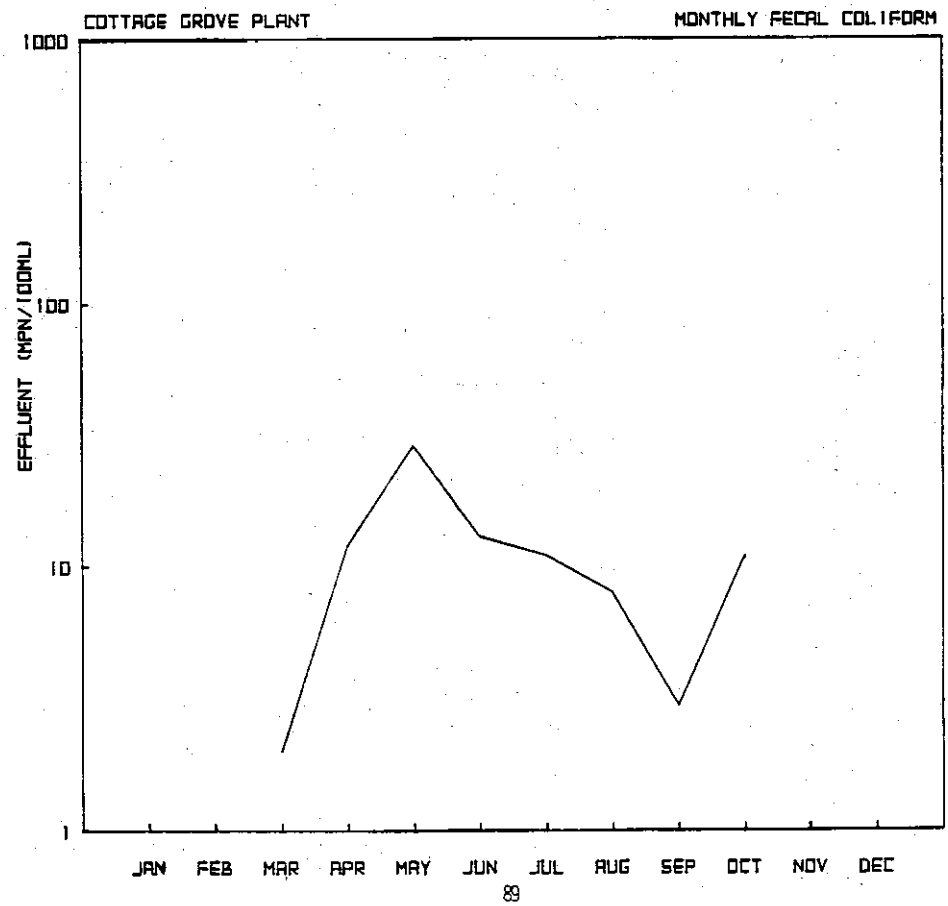
DATA REPRESENTS CBOD IN 1982. ALL RPEVIOUS YEAR'S DATA ARE TBOD.

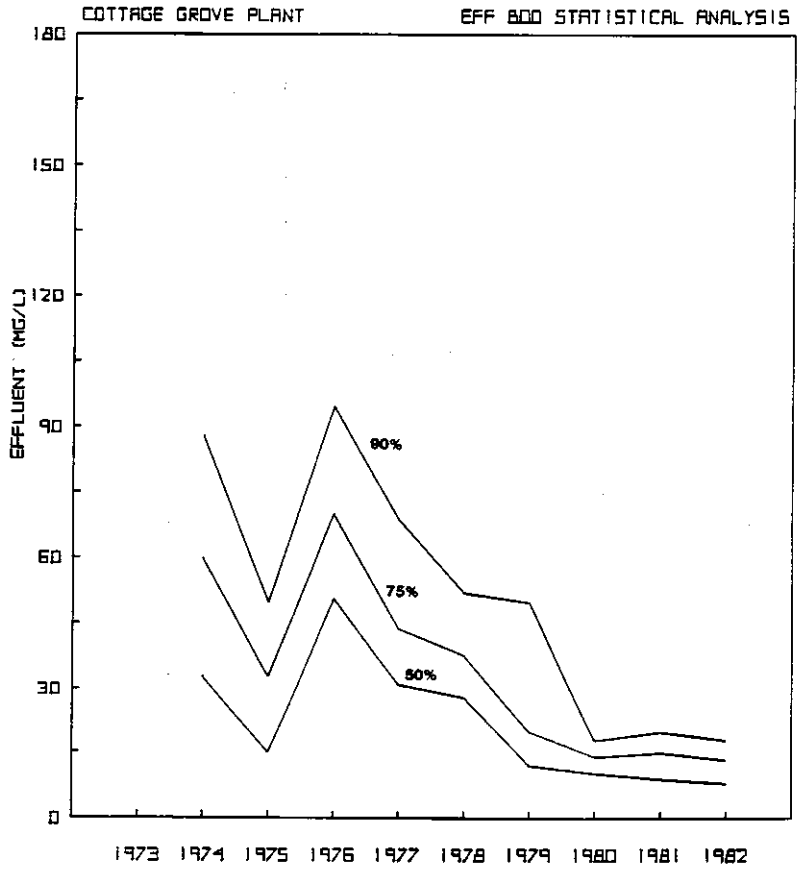


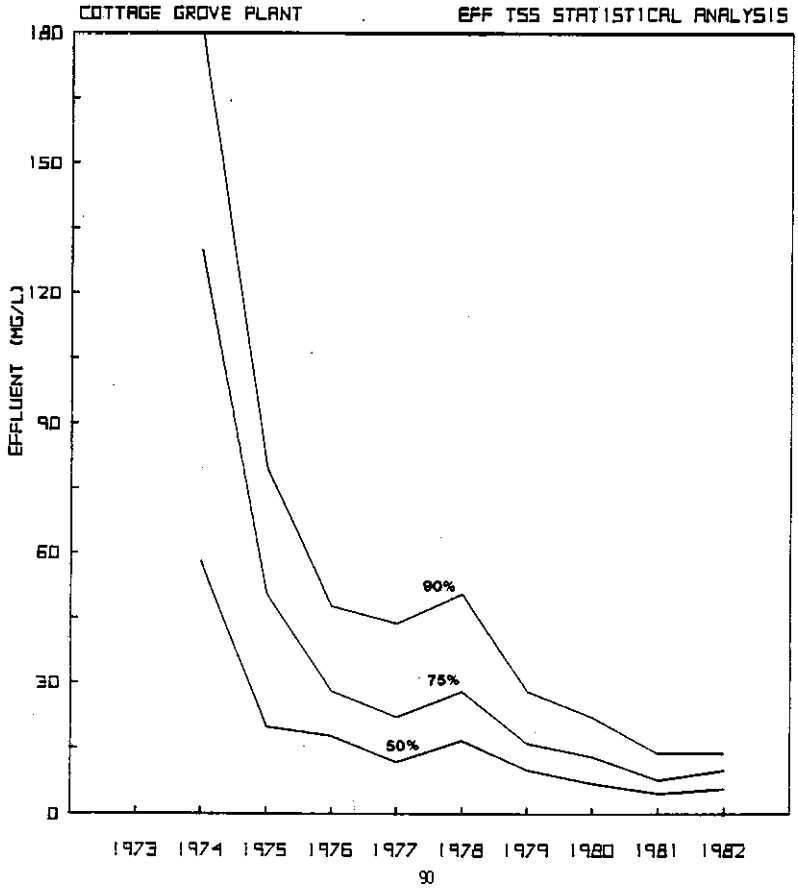

COTTAGE GROVE PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
EFFLUENT (MG/L)
75
50
25
0
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982


COTTAGE GROVE PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
EFFLUENT (MG/L)
30
20
10
0
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


COTTAGE GROVE PLANT
ANNUAL FECAL COLIFORM
1000
100
10
1
EFFLUENT (MPN/100ML)
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982


COTTAGE GROVE PLANT
MONTHLY FECAL COLIFORM
1000
100
10
1
EFFLUENT (MPN/100ML)
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


COTTAGE GROVE PLANT
EFF BOD STATISTICAL ANALYSIS
EFFLUENT (MG/L)
180
150
120
90
60
30
0
90%
75%
50%
1973 1974 1975 1976 1977 1978 1979 1980 1981 1982


COTTAGE GROVE PLANT
EFF TSS STATISTICAL ANALYSIS
EFFLUENT (MG/L)
180
150
120
90
60
30
0
90%
75%
50%
1973 1974 1975 1976 1977 1978 1979 1980 1981 1982

EMPIRE WASTEWATER TREATMENT PLANT

Plant History and Description

The Empire Plant was designed by Short, Elliot, Hendrickson and Associates and was constructed in 1977-1979. The Empire Plant began operation in the fall of 1979. The plant replaced three treatment plants (Lakeville, Farmington, and Apple Valley) which were overloaded and required upgrading to meet water quality based effluent standards. The Empire Plant serves Apple Valley, Empire Township, Farmington, and Lakeville in Service Area No. 6 and has a design capacity of 6.0 mgd.

Liquid treatment consists of screening, influent pumping, grit removal, primary sedimentation, high rate activated sludge aeration, intermediate sedimentation, nitrification activated sludge aeration, final clarification, effluent filtration, chlorination, and discharge to the Vermillion River.

Solids processing consists of combined sludge gravity thickening, anaerobic digestion, centrifuge dewatering, sludge storage and sludge landspreading. The plant is operating at about 70 percent of design capacity and is subject to effluent limits of 10 mg/L BOD and TSS, and 1 mg/L ammonia.

Performance

Plant flow averaged 4.05 mgd, considerably higher than 3.5 mgd in 1981. Average plant effluent quality was 2 mg/L BOD, 1 mg/L TSS and 0.7 mg/L ammonia. Plant performance was good throughout the year even though 3 NPDES Permit violations occurred. The three violations were the result of exceeding monthly ammonia limitations and were caused by high ammonia loading from solids processing recycle streams. Statistical analysis of data show the following trend in effluent BOD and TSS from 1979 through 1982.

Effluent Concentration, mg/l

	50% of Time				75% of Time				90% of Time			
	1979	1980	1981	1982	1979	1980	1981	1982	1979	1980	1981	1982
BOD	4	2	3	2	10	2	4	3	28	5	4	4
TSS	3	1	1	1	5	3	1	1	11	4	2	2

Future

The Empire Plant is one of the Commission's permanent regional plants. Provisions have been made for doubling the plant's capacity when the area's growth requires plant expansion.

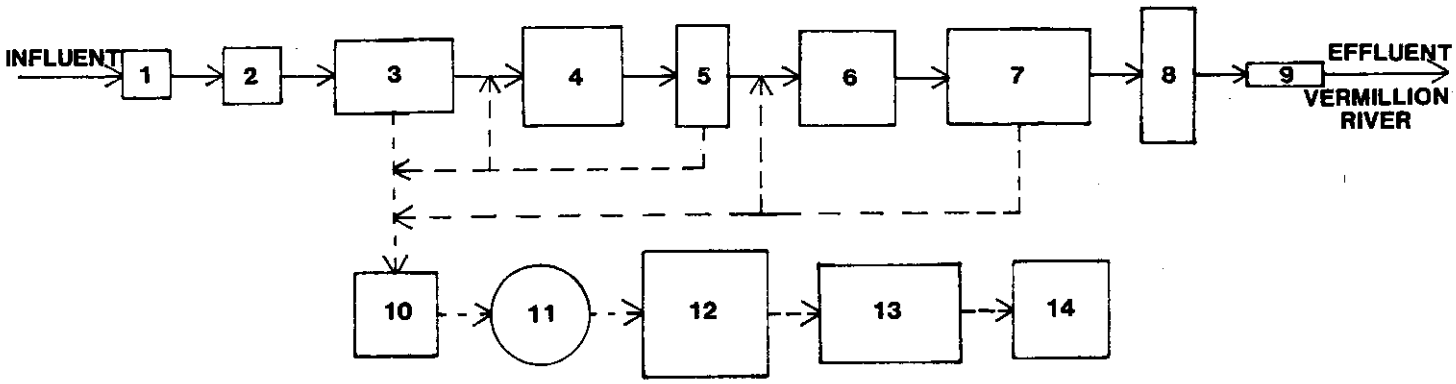
EMPIRE PLANT PROCESS UNIT LOADINGS
1982

Parameter	Annual Average	Maximum Month
Wastewater Flow, MGD	4.05	4.89
BOD Loading, lb/day	6,900	7,600
TSS Loading, lb/day	7,200	9,500
Ammonia Loading, lb/day	740	1,000
Aerated Grit Chamber (One in Use)		
Flow Through Velocity, fps	0.05	0.06
Detention Time, Minutes	12	10
Primary Clarifiers (Two in Use)		
Surface Overflow Rate, gpd/Sq. Ft.	400	490
Weir Overflow Rate, gpd/Lin. Ft.	8,000	9,800
Detention Time, Hr.	5.3	4.4
Removal Efficiency, %BOD	31	32
Removal Efficiency, %TSS	58	70
High Rate Aeration (Two in Use)		
Mixed Liquor Suspended Solids, mg/L	1,600	1,900
F:M Ratio, lb. BOD/Day/lb. MLSS	0.72	0.87
BOD Loading, lb./Day/1000 Cu. Ft.	66	79
Detention Time, Hr.	3.0	2.5
High Rate Clarifiers (Two in Use)		
Surface Overflow Rate, gpd/Sq. Ft.	400	490
Weir Overflow Rate, gpd/Lin. Ft.	8,000	9,800
Detention Time, Hr.	5.3	4.4
Nitrification Aeration (3/2 in Use)		
Mixed Liquor Suspended Solids, mg/L	2,400	2,100
Ammonia: Mass Ratio, lb. NH_3/Day/lb. MLSS	0.024	0.04
Ammonia Loading, lb. NH_3/Day/1000 Cu. Ft.	3.8	5.8
Detention Time, Hr.	6.8	4.9
Nitrification Final Clarifiers (Two in Use)		
Surface Overflow Rate, gpd/Sq. Ft.	320	390
Weir Overflow Rate, gpd/Lin. Ft.	7,200	8,700
Detention Time, Hr.	6.5	5.4
Dual Media Filters		
Filtration Rate, gpd/Sq. Ft.	1.9	2.3

Parameter	Annual Average	Maximum Month
Chlorination		
Chlorine Dose, mg/L	3.6	3.9
Chlorine Use, lb./Day	130	140
Contact Time, Minutes	38	32
Cascade Aeration		
Effluent Dissolved Oxygen, mg/l	8.9	9.8
Gravity Thickener		
Solids Loading, psf/day	4	5
Surface Overflow Rate, gpd/Sq. Ft.	600	600
Sludge Concentration, % TS	3.8	4.9
Anaerobic Digesters (Primary)		
Solids Loading, lb. VS/Cu. Ft./Day	0.04	0.05
Detention Time, Days	40	30
Dewatered Sludge		
Quantity, lb/Day	3,000	5,600
Cake Solids, % TS	13	14

EMPIRE WASTEWATER TREATMENT PLANT

FLOW DIAGRAM



Unit Description

Liquid Phase

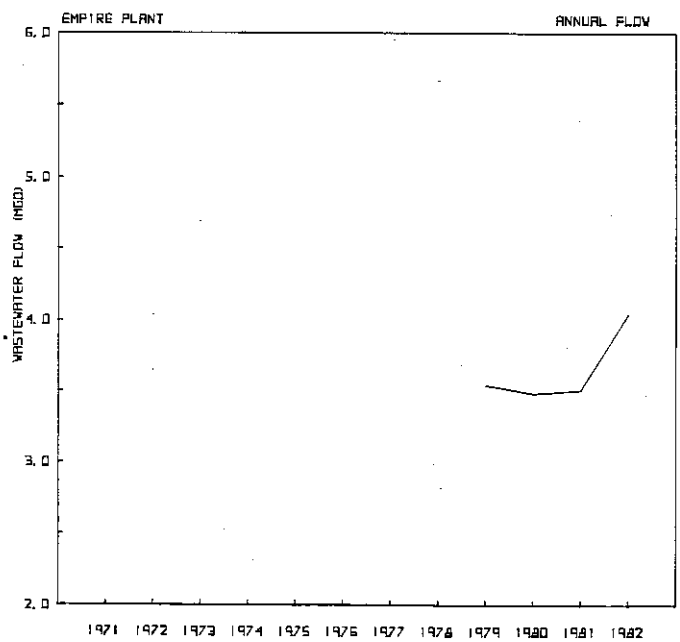
1. Screening
2. Grit Removal
3. Primary Sedimentation
4. Hi-Rate Activated Sludge Aeration
5. Intermediate Clarification
6. Nitrification Activated Sludge Aeration
7. Final Clarification
8. Effluent Filtration
9. Chlorination

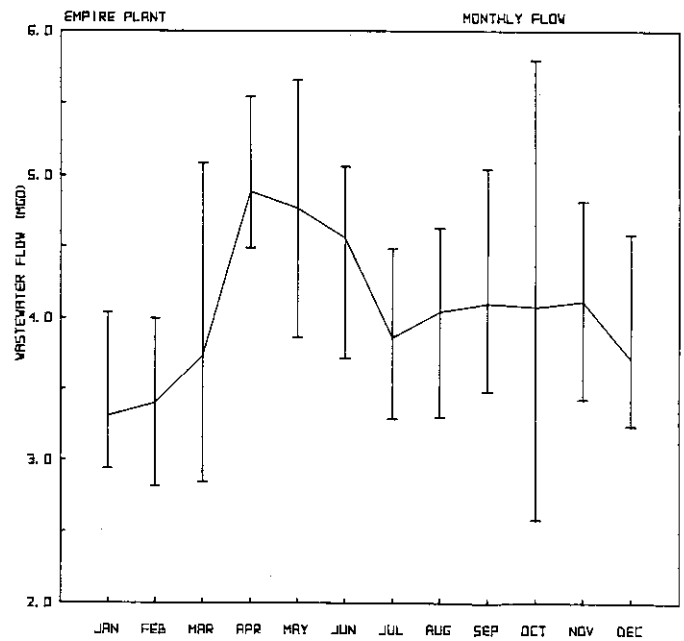
Solids Phase

10. Gravity Thickening
11. Anaerobic Digestion
12. Centrifuge Dewatering
13. Cake Storage
14. Sludge Landspreading

Legend

- Liquid Flow
- Solids Transfer
- Existing Process Units
- Future Process Units



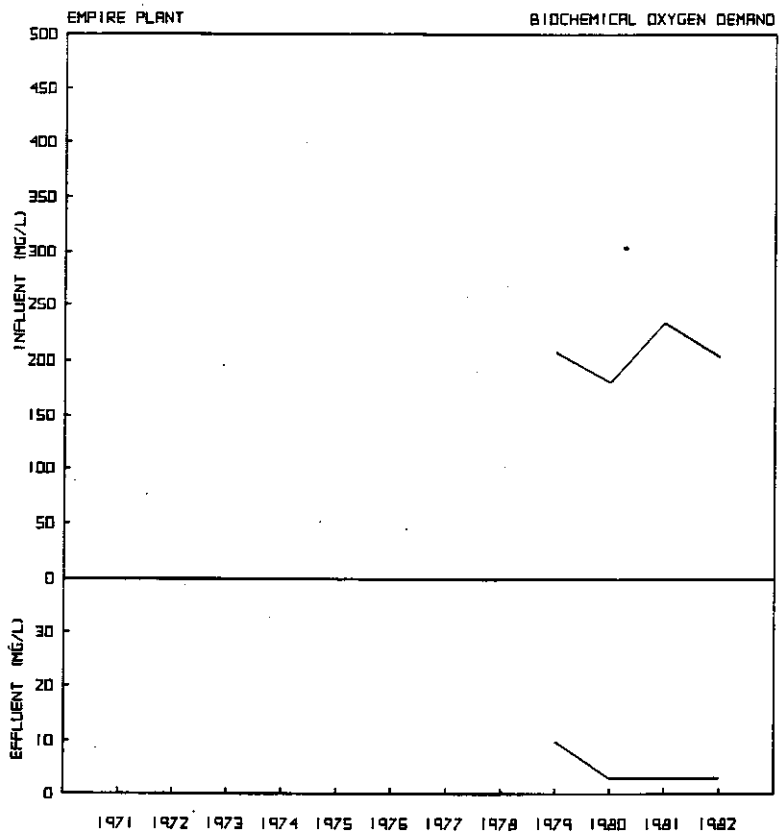


MONTHLY SUMMARY OF INFLUENT QUALITY
TREATMENT PLANT: Empire

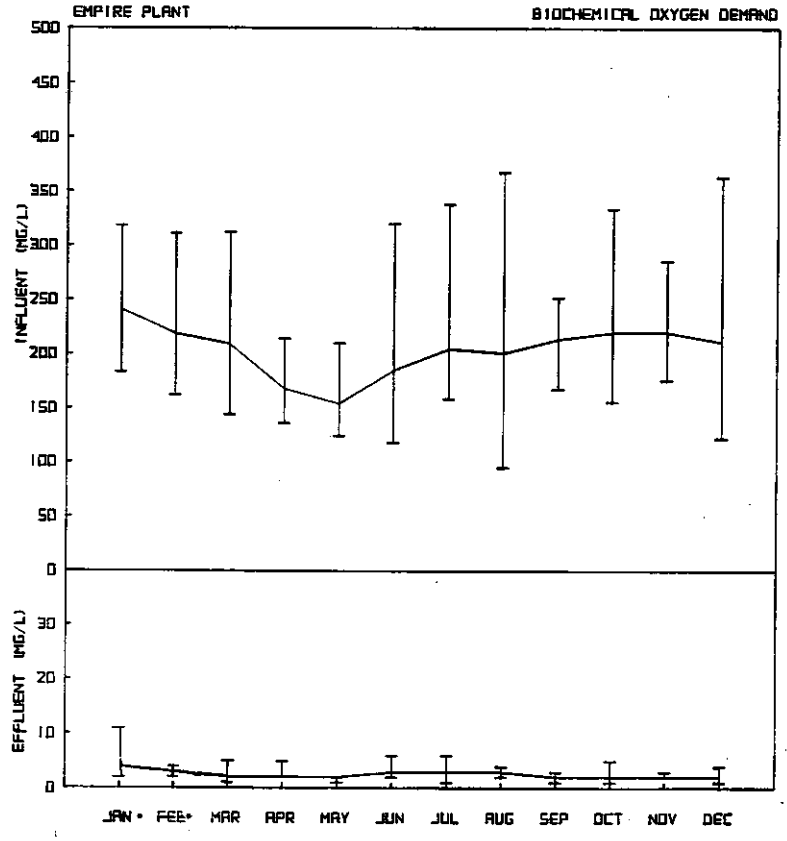
Month	Wastewater Flow, MGD	Temperature °C	TBOD mg/l	TSS mg/l	pH Range	KJN mg/l	Total-P mg/l	NH_3 mg/l	COD mg/l
JANUARY	3.31	11	241	223	6.4-8.4	45.2	14.5	26.3	448
FEBRUARY	3.40	11	218	193	6.1-8.9	48.8	14.3	24.4	412
MARCH	3.74	10	209	176	5.7-9.4	31.1	12.3	19.7	363
APRIL	4.89	11	168	149	6.4-9.2	30.7	9.2	19.6	339
MAY	4.77	12	154	169	6.0-9.2	32.0	9.6	18.4	345
JUNE	4.56	14	185	200	6.5-9.6	33.8	9.4	16.6	389
JULY	3.87	16	205	210	6.0-9.5	38.1	13.8	17.4	389
AUGUST	4.05	18	201	231	6.6-9.5	36.6	14.3	19.0	441
SEPTEMBER	4.10	18	214	266	6.7-8.2	53.5	17.0	30.1	451
OCTOBER	4.08	17	220	233	6.3-10.2	38.7	16.0	23.6	415
NOVEMBER	4.12	15	220	233	6.2-9.6	41.3	15.8	23.4	395
DECEMBER	3.72	13	211	258	6.2-9.0	38.8	13.0	22.9	428
1982 AVERAGE	4.05	14	204	212	5.7-10.2	39.0	13.3	21.8	401
1981 AVERAGE	3.51	14	234	251	5.6-8.8	----	----	----	460

MONTHLY SUMMARY OF EFFLUENT QUALITY
TREATMENT PLANT: Empire

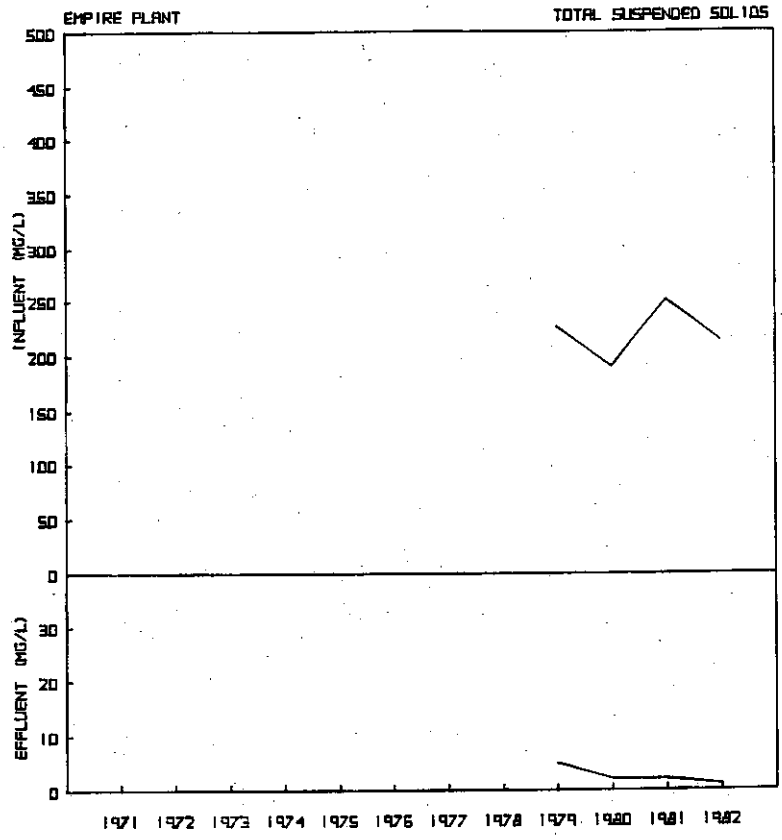
Month	TBOD mg/l	CBOD mg/l	COD mg/l	TSS mg/l	FECAL COLI Geo Mean no/100 ml	TURB NTU	KJN mg/l	NH_3 mg/l	NO_2 mg/l	NO_3 mg/l	Total P mg/l	Cl2 Used lbs	Cl2 Res mg/l	DO mg/l	pH Range	% Removal BOD	% Removal TSS
NPDES LIMIT	10	10	--	10	200	25	---	1.0	----	------	---	---	---	>4.0	6.5-8.5	--	--
JANUARY	4	--	26	1	---	1	2.6	1.6	0.08	25.47	8.0	---	---	9.8	6.9-7.6	99	99
FEBRUARY	3	--	30	1	---	1	2.5	1.1	0.16	27.35	7.9	---	---	9.7	6.8-7.2	99	99
MARCH	2	2	30	2	1	1	2.3	0.9	0.05	22.64	6.8	114	1.2	9.2	6.8-7.4	99	99
APRIL	2	2	28	2	1	1	3.3	3.0	0.07	21.93	7.1	137	2.0	9.3	6.7-7.2	99	99
MAY	2	2	34	1	2	1	2.0	0.2	0.06	22.94	7.3	129	1.6	8.9	6.7-7.8	99	99
JUNE	3	3	29	2	1	1	2.0	0.1	0.04	21.78	6.6	135	1.9	8.3	6.6-7.9	98	99
JULY	4	3	22	1	1	1	1.5	0.1	0.18	24.38	6.1	126	2.0	7.6	6.5-7.6	98	99
AUGUST	3	3	25	1	3	1	1.6	0.1	0.18	25.52	7.7	129	1.7	8.9	6.8-7.3	99	99
SEPTEMBER	2	2	24	1	1	1	2.0	0.2	0.20	33.26	7.8	131	1.7	7.7	6.6-7.5	99	99
OCTOBER	2	2	27	1	1	1	1.7	0.3	0.11	29.68	8.2	126	2.2	7.8	6.5-7.4	99	99
NOVEMBER	3	2	21	1	---	0.5	2.0	0.5	0.13	26.02	6.4	---	---	9.4	6.7-7.7	99	99
DECEMBER	4	2	25	1	---	1	2.2	0.6	0.23	23.26	5.2	---	---	9.7	6.7-7.4	99	99
1982 AVG.	3	2	27	1	1	1	2.1	0.7	0.12	25.35	7.1	128	1.8	8.9	6.5-7.9	99	99
1981 AVG.	3	--	25	2	3	1	2.2	0.3	0.15	25.41	5.7	98	1.0	8.5	6.7-7.8	99	99

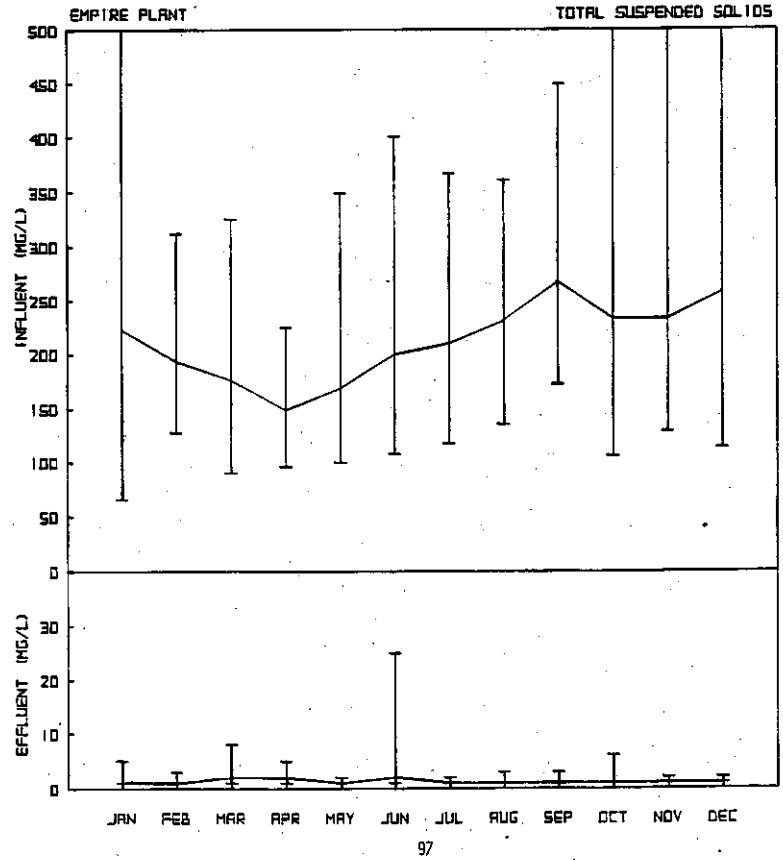


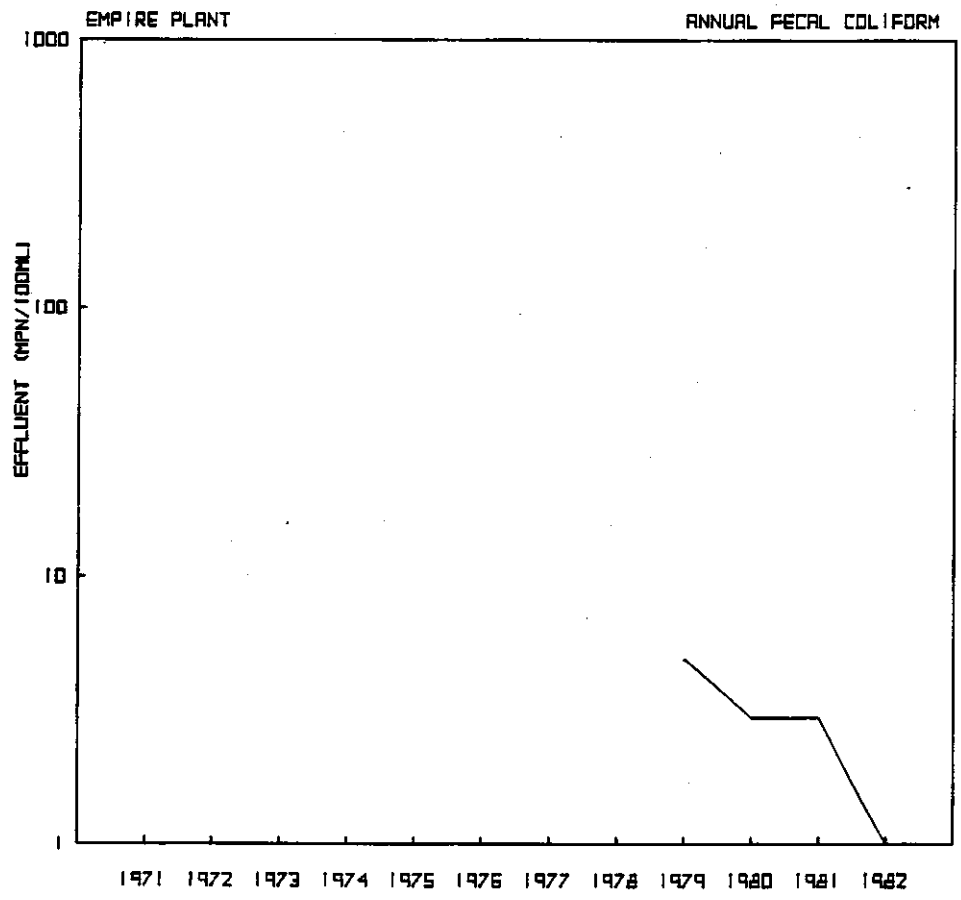
DATA REPRESENTS CBOD IN 1982. ALL PREVIOUS YEAR'S DATA ARE TBOD.

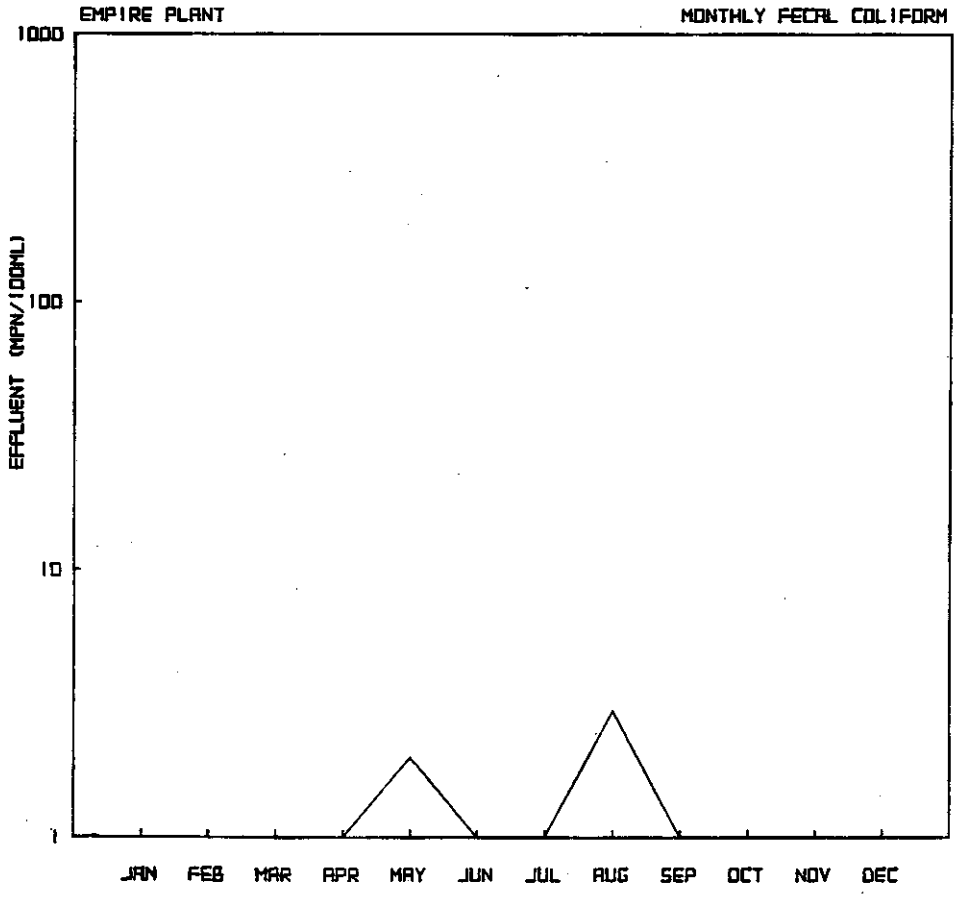


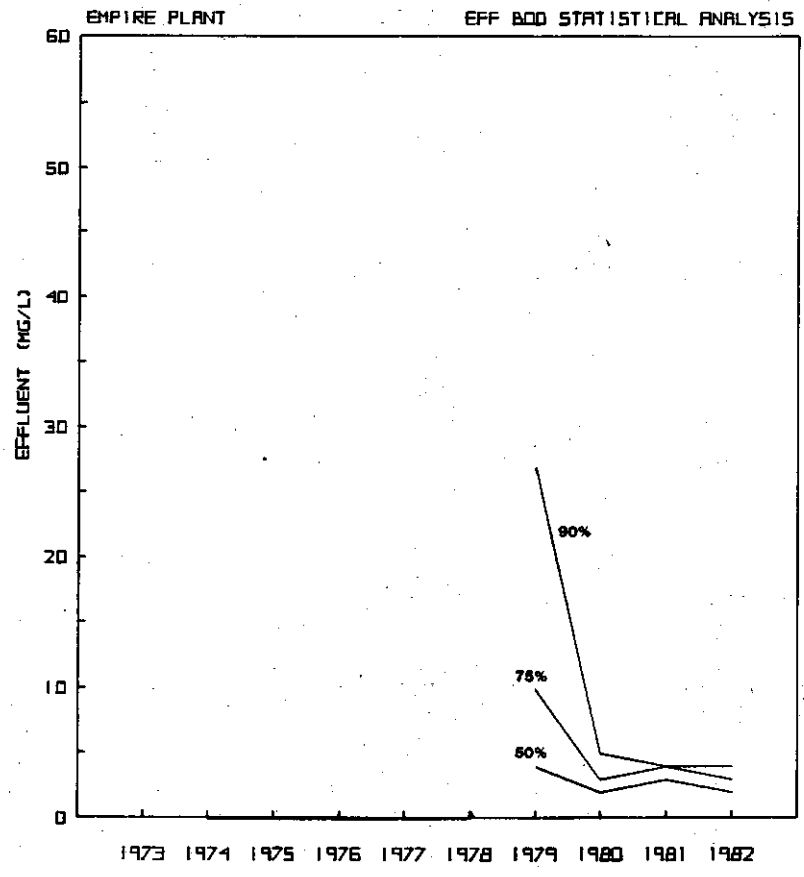
*NO CBOD DONE, TBOD'S ARE GRAPHED.

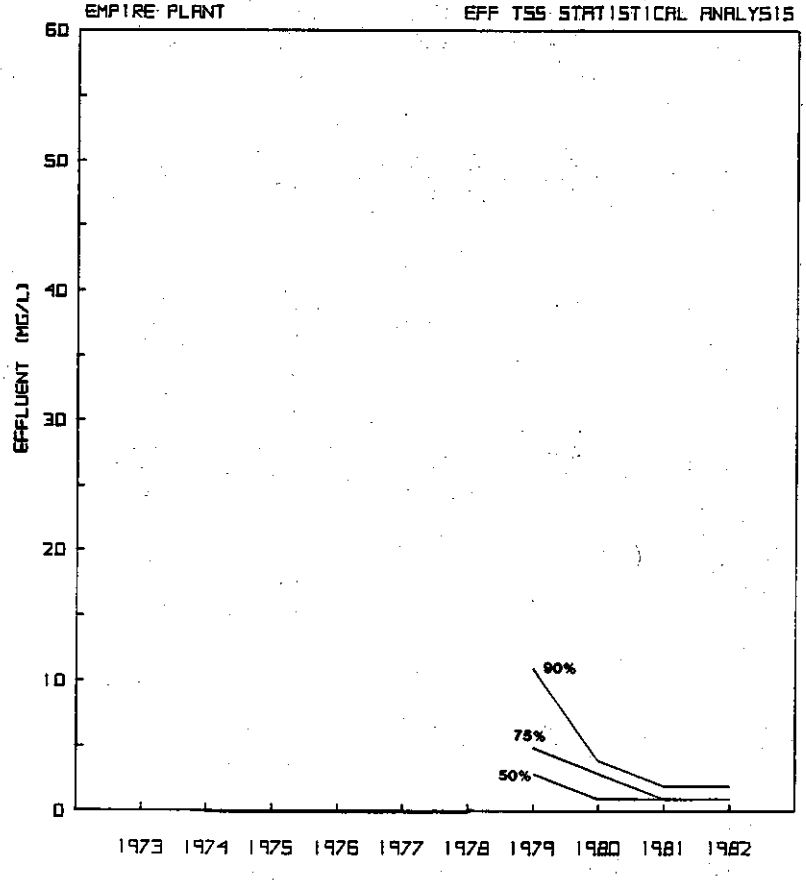

EMPIRE PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
EFFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
30
20
10
0
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982


EMPIRE PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
EFFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
30
20
10
0
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


EMPIRE PLANT
ANNUAL FECAL COLIFORM
1000
100
10
1
EFFLUENT (MPN/100ML)
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982


EMPIRE PLANT
MONTHLY FECAL COLIFORM
1000
100
10
1
EFFLUENT (MPN/100ML)
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


EMPIRE PLANT
EFF BOD STATISTICAL ANALYSIS
EFFLUENT (MG/L)
60
50
40
30
20
10
0
90%
75%
50%
1973 1974 1975 1976 1977 1978 1979 1980 1981 1982


EMPIRE PLANT
EFF TSS STATISTICAL ANALYSIS
EFFLUENT (MG/L)
60
50
40
30
20
10
0
90%
75%
50%
1973 1974 1975 1976 1977 1978 1979 1980 1981 1982

HASTINGS WASTEWATER TREATMENT PLANT

Plant History and Description

The Hastings Plant was designed by Toltz, King, DuVall, Anderson, and Associates and built in 1955 as a "primary treatment" plant. Principal items included a primary control building, primary settling and chlorination tanks, anaerobic digester, and sludge drying beds. In 1967, the plant was modified to include secondary treatment facilities. Major additions included one four-pass aeration tank, two final settling tanks, a chlorine contact tank and a secondary sludge digester. After 1967 modifications, the plant's design capacity was 1.83 mgd. Actual operating capacity is somewhat less, estimated to be about 1.5 mgd.

Liquid treatment consists of screening, grit removal, primary sedimentation, primary effluent pumping, activated sludge aeration, final clarification, chlorination, and discharge to the Mississippi River.

Solids processing consists of combined thickening in primary tanks, anaerobic digestion with ultimate disposal by landspreading or through the Metropolitan Plant Interceptor System. The Hastings Plant is operating near its effective capacity and is subject to secondary treatment limits.

Performance

Plant flow averaged 1.50 mgd in 1982, unchanged from that of 1981. Average plant effluent quality was 20 mg/L BOD and 31 mg/L TSS. Plant performance was marginal due to operation near plant capacity. A total of 18 NPDES violations occurred throughout the year. Statistical analysis of data show the following trend in effluent quality from 1979 through 1982.

Effluent Concentration, mg/l

	50% of Time				75% of Time				90% of Time			
	1979	1980	1981	1982	1979	1980	1981	1982	1979	1980	1981	1982
BOD	16	17	18	17	22	22	24	27	28	31	33	37
TSS	17	22	19	28	24	30	28	38	31	38	36	48

Future

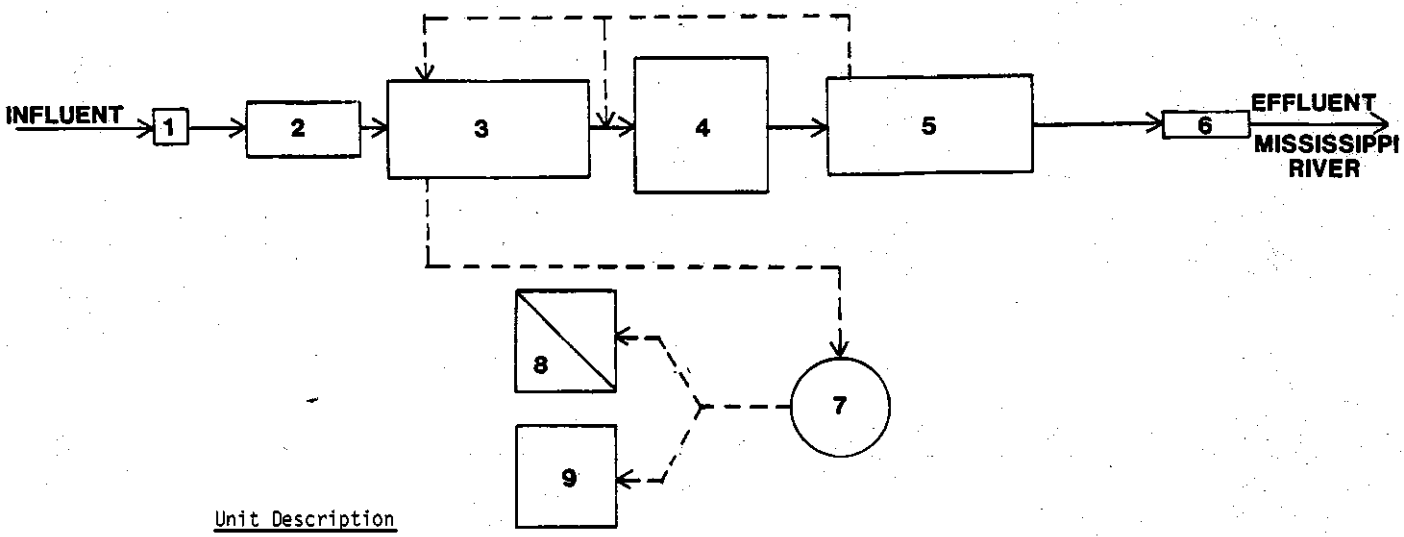
The Hastings Plant will be expanded to a capacity of 2.34 mgd. Construction grants for a plant expansion were received and construction is expected to begin in late 1983. Completion of the plant expansion is scheduled for late 1985.

HASTINGS PLANT PROCESS UNIT LOADINGS
1982

Parameter	Annual Average	Maximum Month
Wastewater Flow, MGD	1.50	1.63
BOD Loading, lb/day	3,140	3,550
TSS Loading, lb/day	2,930	3,820
COD Loading, lb/day	6,770	8,120
Primary Sedimentation		
Surface Overflow Rate, gpd/Sq. Ft.	1,330	1,390
Aeration Tanks		
BOD Loading, lb/Day/1,000 Cu. Ft.	45	51
Final Sedimentation		
Weir Overflow Rate, gpd/Lin. Ft.	9,100	9,900
Surface Overflow Rate, gpd/Sq. Ft.	625	680
Chlorination		
Contact Time - Primary, Minutes	37	34
Contact Time - Secondary, Minutes	10	10
Chlorine Use, lb/day	126	185
Sludge Transport		
Volume, gpd	7,560	9,810
Mass, lb/day	2,000	2,550

HASTINGS WASTEWATER TREATMENT PLANT

FLOW DIAGRAM



Unit Description

Liquid Phase

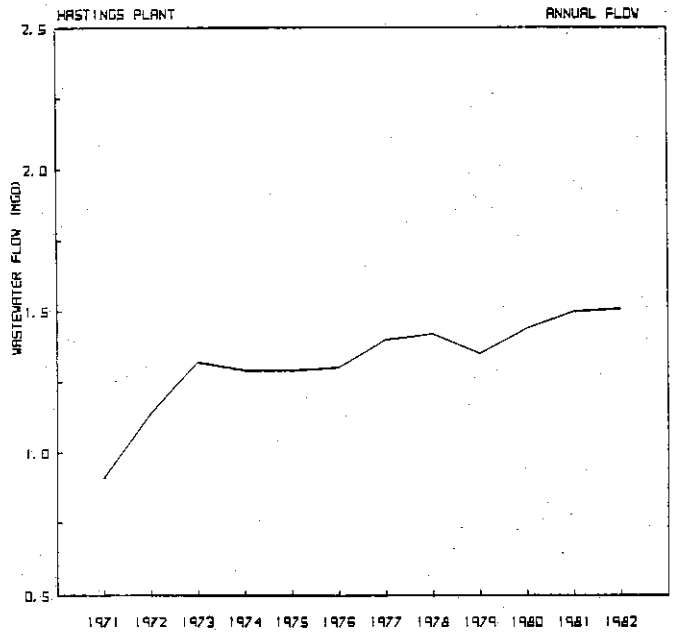
1. Screening
2. Grit Removal
3. Primary Sedimentation
4. Activated Sludge
5. Final Sedimentation
6. Chlorination

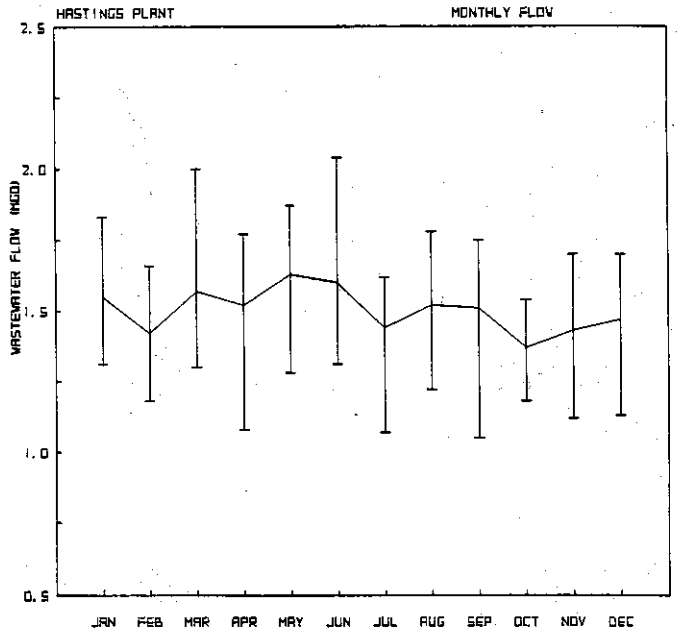
Solid Phase

7. Anaerobic Digestion
8. Solids Disposal at Metro Plant
9. Land Spreading

Legend

- Liquid Flow
- Solids Transfer
- Existing Process Units
- Future Process Units



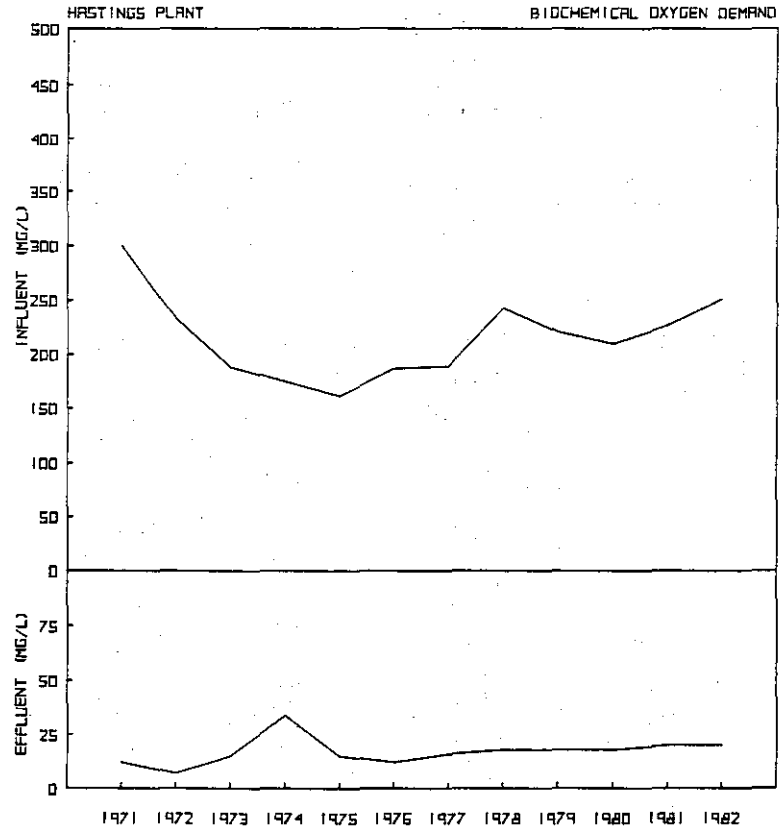


MONTHLY SUMMARY OF INFLUENT QUALITY
TREATMENT PLANT: Hastings

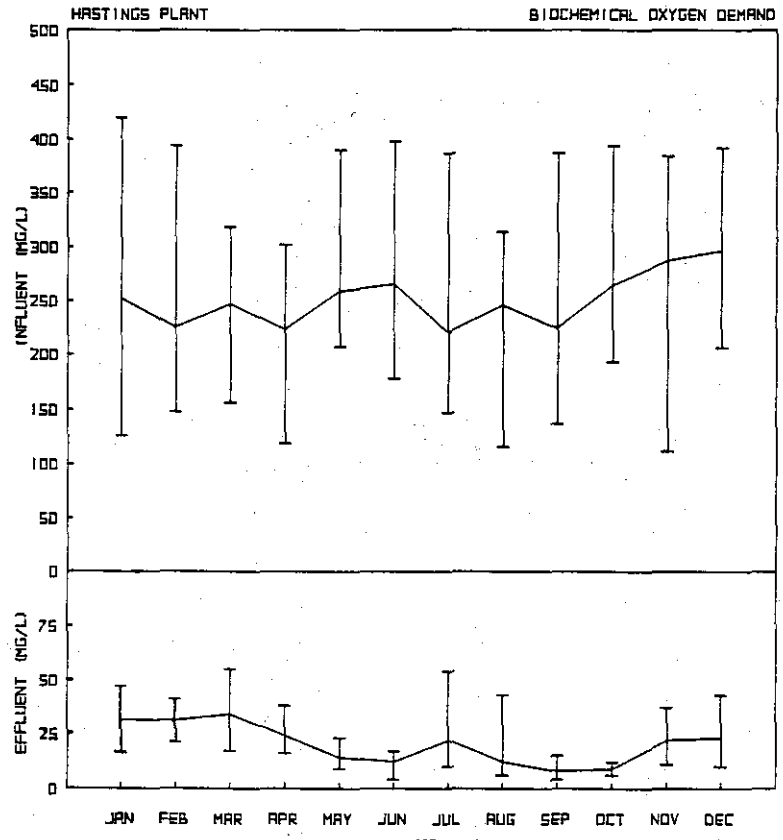
Month	Wastewater Flow, MGD	Temperature °C	TBOD mg/l	TSS mg/l	pH Range	KJN mg/l	Total-P mg/l	NH_3 mg/l	COD mg/l
JANUARY	1.55	13	252	212	6.1-11.6	56.0	11.5	28.0	554
FEBRUARY	1.42	12	225	240	6.0-9.6	54.0	13.0	26.4	553
MARCH	1.57	12	247	222	6.0-9.4	37.6	10.5	25.8	546
APRIL	1.52	12	223	223	6.1-9.7	54.0	10.7	30.9	531
MAY	1.63	14	259	281	4.1-12.0	47.5	10.3	21.9	597
JUNE	1.60	18	266	243	5.1-11.4	53.2	12.6	31.1	546
JULY	1.44	19	220	174	3.7-9.4	46.2	9.1	27.3	440
AUGUST	1.52	21	246	259	3.0-12.0	44.0	11.6	19.4	517
SEPTEMBER	1.51	21	224	218	3.7-10.8	48.5	9.8	26.6	484
OCTOBER	1.37	20	265	205	5.7-10.3	44.0	10.8	23.8	529
NOVEMBER	1.43	18	288	284	5.8-11.0	40.8	13.2	25.6	582
DECEMBER	1.47	16	297	234	6.2-10.2	36.8	10.8	25.6	610
1982 AVERAGE	1.50	16	251	233	3.0-12.0	46.9	11.1	26.0	541
1981 AVERAGE	1.50	17	227	235	5.6-10.8	----	----	----	488

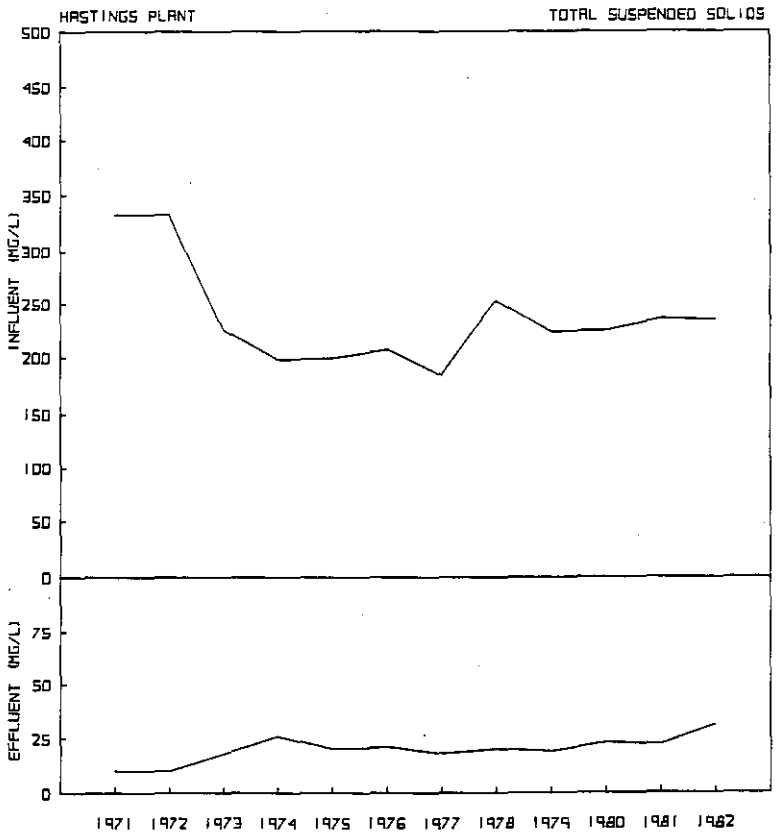
MONTHLY SUMMARY OF EFFLUENT QUALITY
TREATMENT PLANT: Hastings

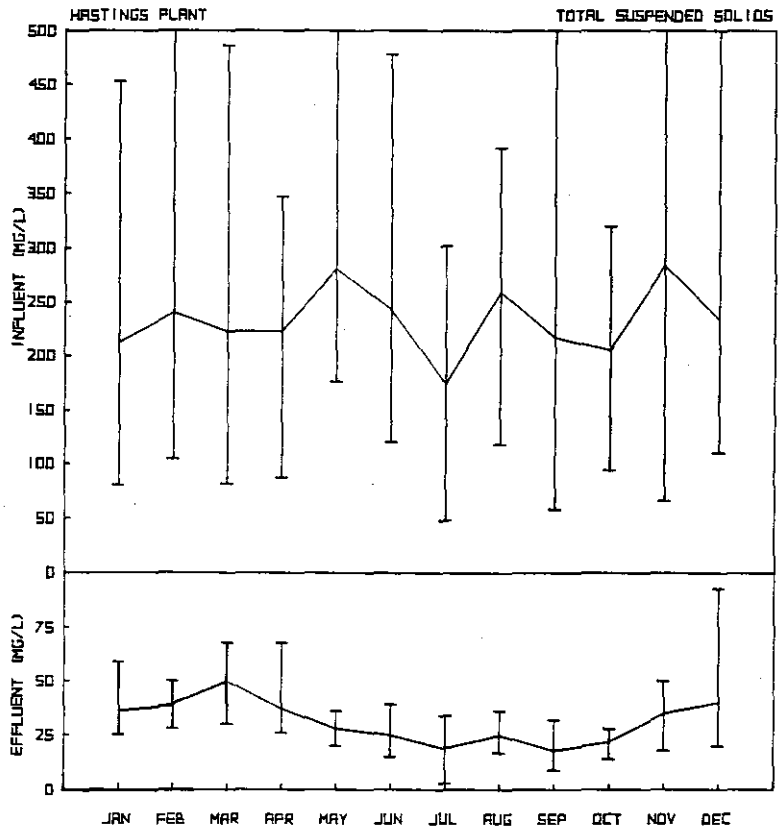
Month	TBOD mg/l	CBOD mg/l	COD mg/l	TSS mg/l	FECAL COLI Geo Mean no/100 ml	TURB NTU	KJN mg/l	NH_3 mg/l	NO_2 mg/l	NO_3 mg/l	Total P mg/l	Cl2 Used lbs	Cl2 Res mg/l	DO mg/l	pH Range	% Removal BOD	% Removal TSS
NPDES LIMIT	25	25	---	30	200	25	-----	-----	-----	-----	---	---	---	---	6.5-8.5	--	--
JANUARY	42	31	154	36	---	14	31.5	20.1	4.28	2.14	7.2	---	---	6.1	7.2-7.6	88	83
FEBRUARY	56	31	151	39	---	14	35.4	20.9	1.02	4.63	8.1	---	---	6.2	7.2-7.8	86	84
MARCH	36	34	190	50	7	23	32.7	22.0	0.57	0.89	7.6	107	4.2	6.1	7.0-7.8	86	77
APRIL	25	24	147	37	2	17	32.6	24.2	0.63	2.26	6.4	115	5.2	6.0	7.1-7.6	89	83
MAY	22	14	103	28	18	12	26.0	17.3	1.43	3.29	3.2	109	3.4	6.2	7.1-7.6	95	90
JUNE	18	12	107	25	8	10	31.7	20.7	1.01	4.14	2.9	118	4.0	7.0	7.1-7.6	96	90
JULY	31	22	113	19	43	13	24.5	13.9	2.14	6.14	5.4	146	4.5	5.3	7.0-7.4	90	89
AUGUST	17	12	93	25	46	10	26.9	15.6	0.80	1.16	2.3	183	5.8	5.1	6.5-7.4	95	90
SEPTEMBER	10	8	75	18	6	7	19.3	10.0	0.38	4.41	1.8	154	7.4	5.3	6.5-7.6	96	92
OCTOBER	10	9	100	22	38	8	23.3	12.1	0.53	2.06	2.8	135	5.5	5.8	6.8-7.8	97	89
NOVEMBER	51	22	104	35	---	9	22.2	14.9	1.68	7.03	3.1	---	---	6.1	6.8-7.6	92	88
DECEMBER	52	23	106	40	---	10	26.9	20.1	0.71	4.97	3.0	---	---	6.5	6.7-7.4	92	83
1982 AVG.	31	20	120	31	21	12	27.7	17.6	1.27	3.59	4.5	133	5.0	6.0	6.5-7.8	92	87
1981 AVG.	20	--	100	22	11	11	32.0	20.6	1.58	1.75	5.8	168	6.7	6.2	7.1-7.3	91	91

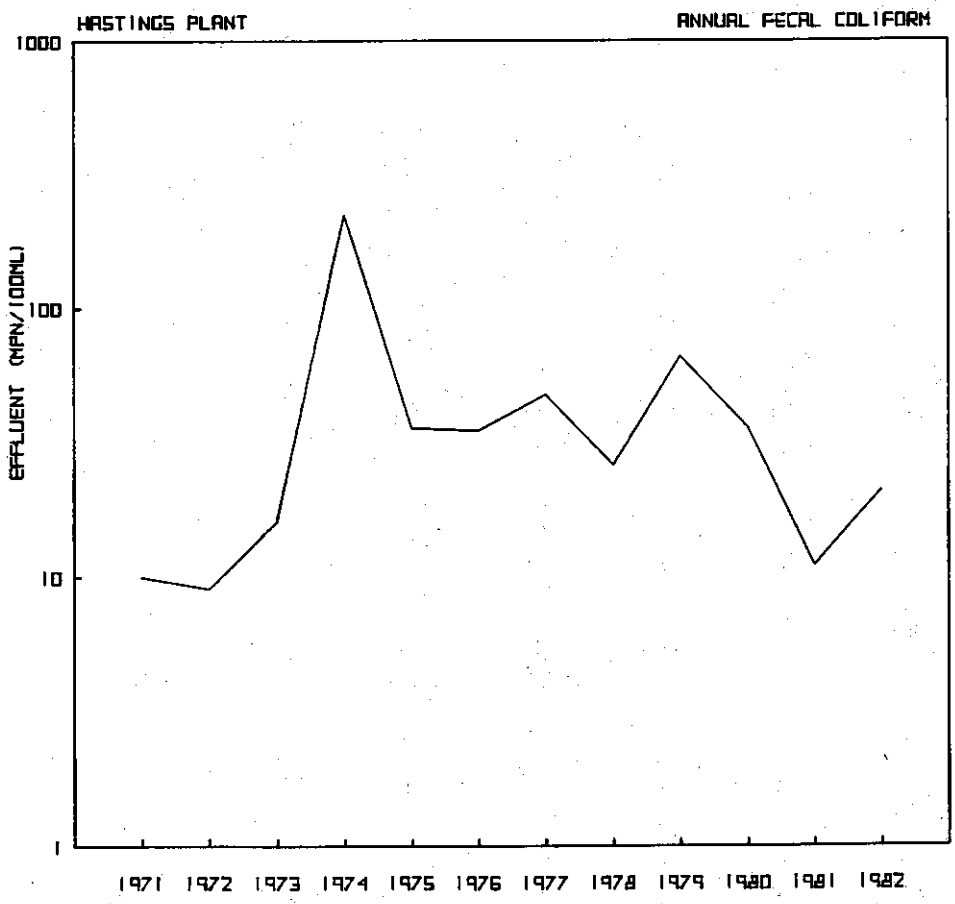


DATA REPRESENTS CBOD IN 1982. ALL PREVIOUS YEAR'S DATA ARE TBOD.




HASTINGS PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
EFFLUENT (MG/L)
75
50
25
0
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982


HASTINGS PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
EFFLUENT (MG/L)
75
50
25
0
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC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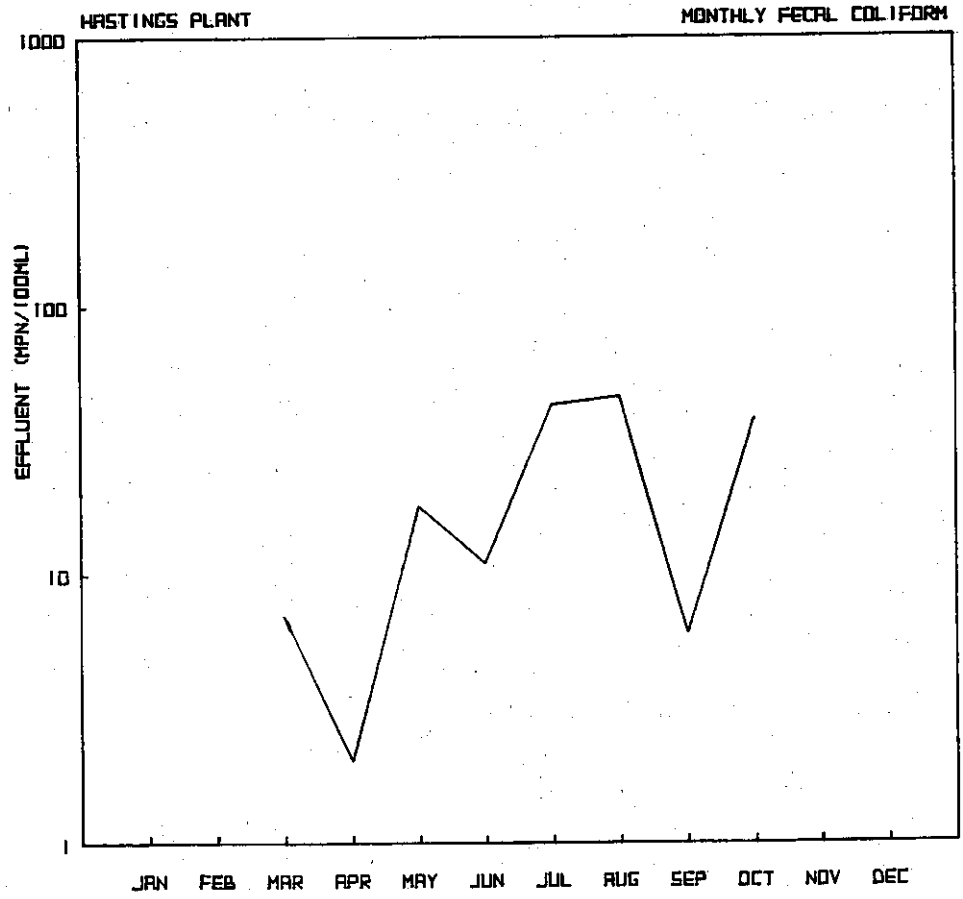
ANNUAL FECAL COLIFORM
1000
100
10
1
EFFLUENT (MPN/100ML)
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982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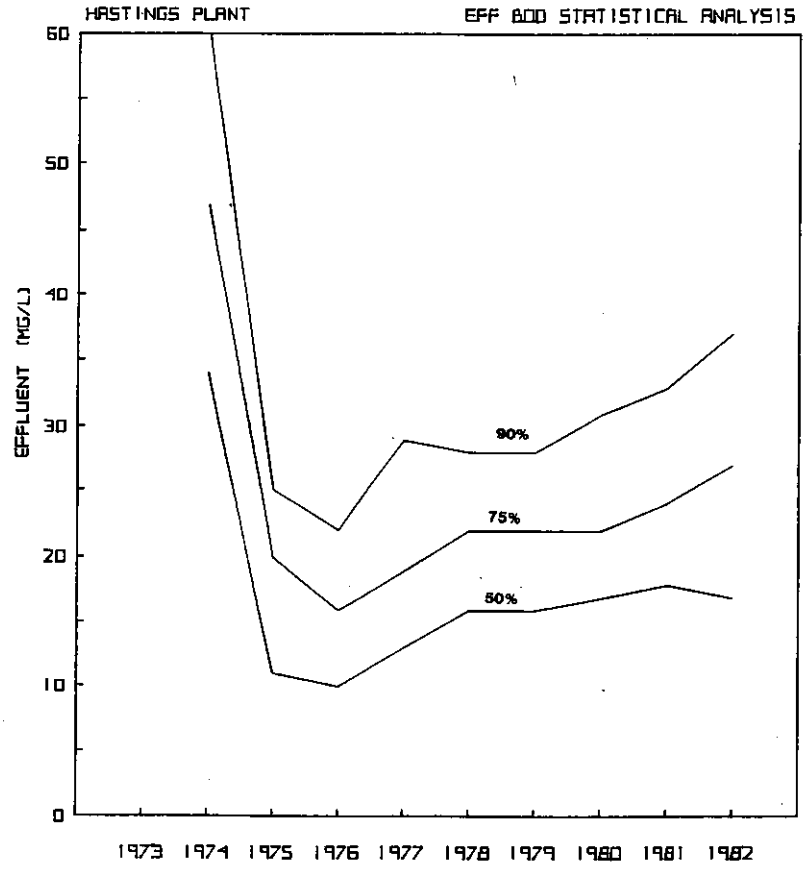
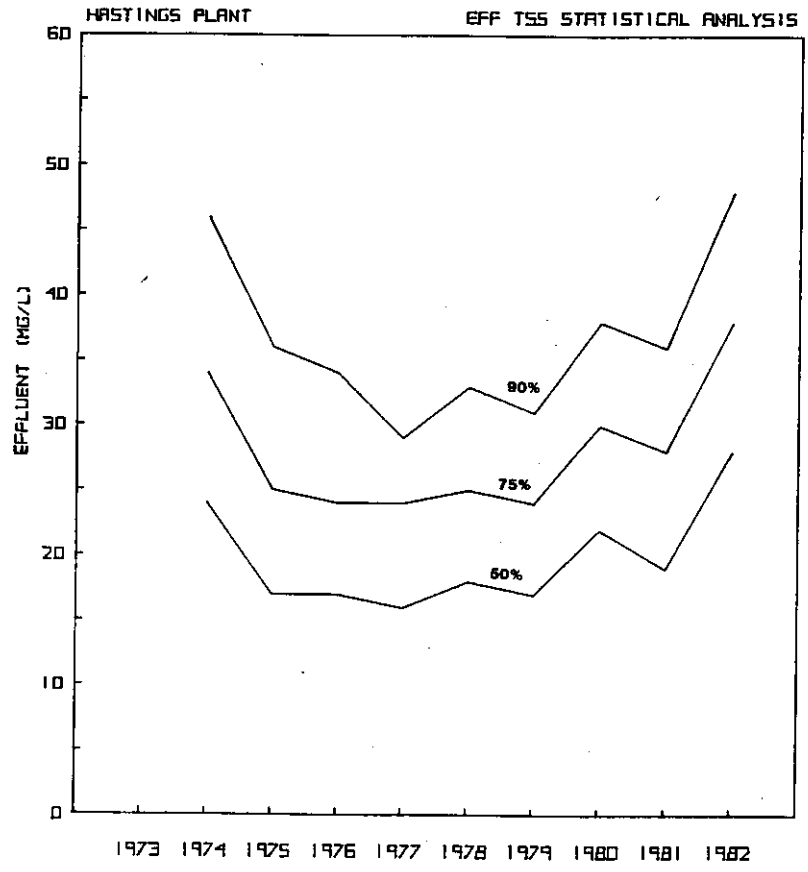
MONTHLY FECAL COLIFORM
1000
100
10
1
EFFLUENT (MPN/100ML)
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


HASTINGS PLANT
EFF BOD STATISTICAL ANALYSIS
EFFLUENT (MG/L)
60
50
40
30
20
10
0
90%
75%
50%
1973 1974 1975 1976 1977 1978 1979 1980 1981 1982


HASTINGS PLANT
EFF TSS STATISTICAL ANALYSIS
EFFLUENT (MG/L)
60
50
40
30
20
10
0
90%
75%
50%
1973 1974 1975 1976 1977 1978 1979 1980 1981 1982

1982 EFFLUENT DATA
TREATMENT PLANT Hastings

MONTH	Cu mg/l	Cr mg/l	Zn mg/l	Pb mg/l	Cd mg/l	Hg ug/l	CN mg/l	As ug/l	Sn mg/l	Ni mg/l	Phenol ug/l	Fe mg/l	PCB ug/l
January	0.56	0.80	0.09			<0.20	0.195				7.3		
February	0.47	0.81	0.12			<0.12	0.125				9.7		
March	0.45	1.14	0.13	<0.05	<0.008	<0.10	0.018			<0.04	5.0	0.33	
April	0.49	0.73	0.16			<0.15	0.013				6.9		
May	0.37	0.30	0.14			<0.20	<0.090				6.5		
June	0.25	0.27	0.12			<0.22	<0.034				4.0		
July	0.20	0.35	0.12	<0.05	<0.008	<0.20	<0.047			<0.04	7.2	0.23	
August	0.26	0.43	0.11	<0.05	<0.008	<0.22	0.073			<0.04	5.6	0.32	
September	0.18	0.24	0.13			<0.28	<0.096				5.5		
October	0.25	0.23	0.10			<0.20	0.093				5.9		
November	0.39	0.27	0.09			<0.20	0.145				4.7		
December	0.68	0.15	0.08	<0.05	<0.008	<0.20	0.046			0.06	4.9	0.48	
1982 Avg.	0.38	0.48	0.12	<0.05	<0.008	<0.19	<0.08			<0.05	6.1	0.34	

MAPLE PLAIN WASTEWATER TREATMENT PLANT

Plant History and Description

The original Maple Plain Plant was designed by Toltz, King, DuVall, Anderson and Associates and constructed in 1952. A plant expansion was designed by W.T. Mills, and constructed in 1965. Current plant design capacity is 0.22 mgd.

Liquid treatment consists of grit removal, screening, influent pumping, primary sedimentation, roughing trickling filter, complete mix activated sludge aeration, final clarification, chlorination, effluent polishing pond, and discharge through a swamp to Lake Minnetonka.

Solids processing consists of combined thickening in primary tanks, anaerobic digestion, and sludge hauling to other plants for processing or to landspreading sites.

The plant is presently operated at about 150 percent of its rated hydraulic capacity and is subject to secondary treatment limits.

Performance

Plant flow averaged 0.35 mgd in 1982, a significant increase from 0.25 mgd in 1981. Average plant effluent quality was 13 mg/L BOD and 7 mg/L TSS. Although the flow was in excess of plant capacity, plant performance was good throughout the year. Two NPDES Permit violations occurred during 1982. These violations consisted of failing to meet monthly BOD limitations for the months of January and April and were the result of process problems and high flows. Statistical analysis of data show the following trend in effluent BOD and TSS from 1979 through 1982.

Effluent Concentration, mg/l

	50% of Time				75% of Time				90% of Time			
	1979	1980	1981	1982	1979	1980	1981	1982	1979	1980	1981	1982
BOD	16	19	10	11	23	29	15	18	33	37	21	26
TSS	10	11	6	6	18	15	8	10	30	24	16	16

Future

The future of the Maple Plain Plant is uncertain. The plant will either be phased out by construction of an interceptor at the Blue Lake Plant, or it will be upgraded for higher levels of treatment including phosphorus removal.

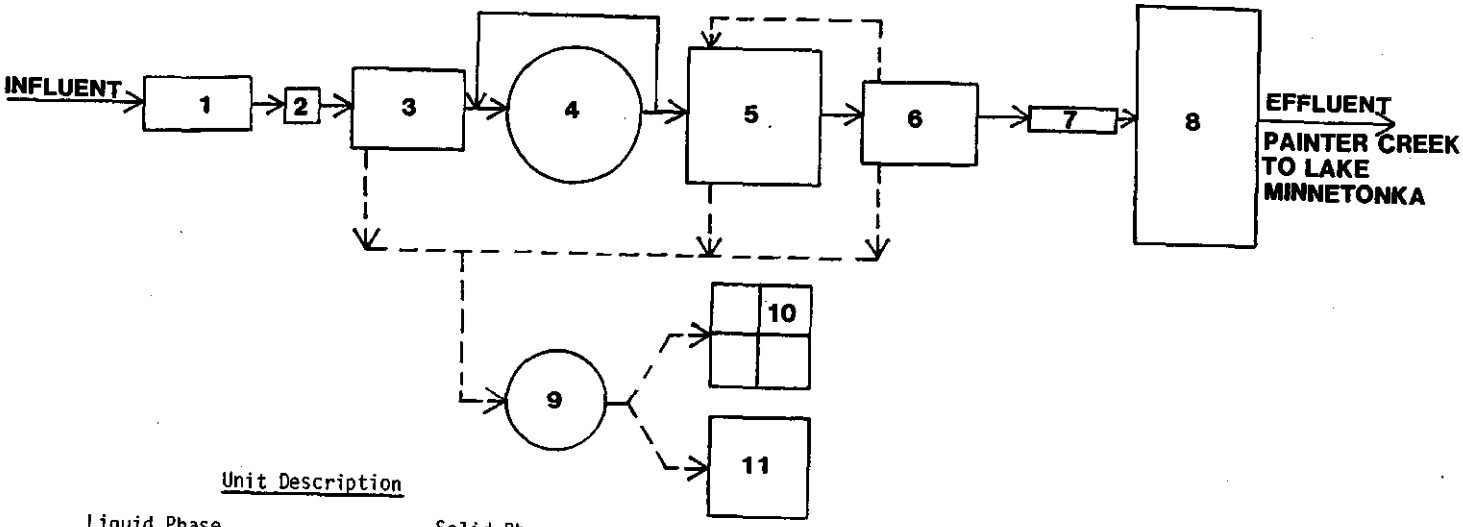
MAPLE PLAIN PLANT PROCESS UNIT LOADINGS
1982

Parameter	Annual Average	Maximum Month
Wastewater Flow, MGD	0.35	0.59
BOD Loading, lb/day	425	490
TSS Loading, lb/day	580	1,080
COD Loading, lb/day	860	1,090
Sludge Production, lb/day	80	-----
Grit Removal		
Overflow Rate, gpd/Sq. Ft.	21,880	36,880
Primary Sedimentation		
Detention Time, Hr.	0.7	0.4
Weir Overflow Rate, gpd/Lin. Ft.	9,720	16,390
Surface Overflow Rate, gpd/Sq. Ft.	1,440	2,430
Trickling Filters		
Hyraulic Loading, gpd/Sq. Ft.	220	370
BOD_5 Loading, lb/Day/1000 Cu. Ft.	41	47
Aeration Tanks		
Detention Time, Hr.	7.1	4.2
BOD_5 Loading, lb/Day/1000 Cu. Ft. (Assume 50% trickling filter reduction)	±15	±18
Final Sedimentation		
Detention Time, Hr.	2.0	1.2
Weir Overflow Rate, gpd/Lin. Ft.	8,970	15,130
Surface Overflow Rate, gpd/Sq. Ft.	1,030	1,730
Chlorination		
Contact Time, Minutes	15	9
Chlorine Use, lb/day	36	50
Polishing Pond		
Detention Time, Days	2.9	1.7
BOD_5, lb/acre/day	59	150

Anaerobic Digestion (Prim. Dig. Only)		
Solids Loading, lb/Cu. Ft./Day	0.08	-----
Detention Time, Days	29	-----
Sludge Transport		
Volume, Gal/day	160	-----

MAPLE PLAIN WASTEWATER TREATMENT PLANT

FLOW DIAGRAM



Unit Description

Liquid Phase

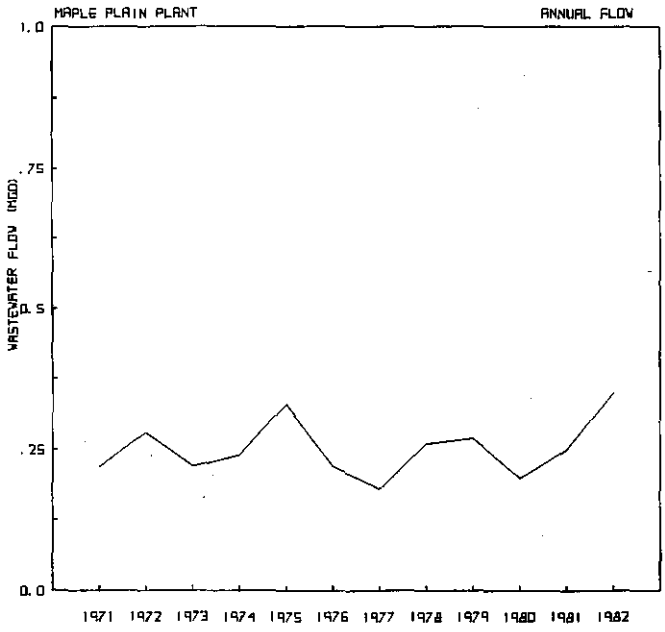
1. Grit Removal
2. Screening
3. Primary Sedimentation
4. Trickling Filter
5. Activated Sludge
6. Final Sedimentation
7. Chlorination
8. Effluent Pond

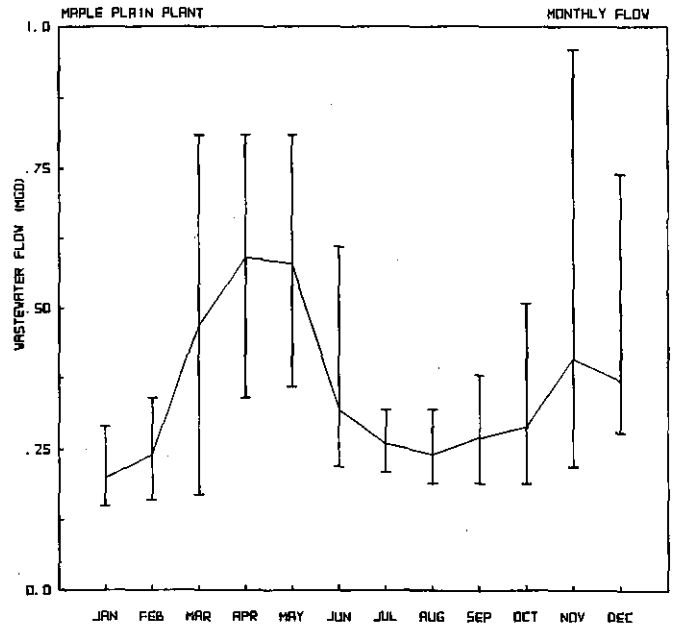
Solid Phase

9. Anaerobic Digestion
10. Sand Drying Beds
11. Land Spread

Legend

- Liquid Flow
- Solids Transfer
- Existing Process Units
- Future Process Units



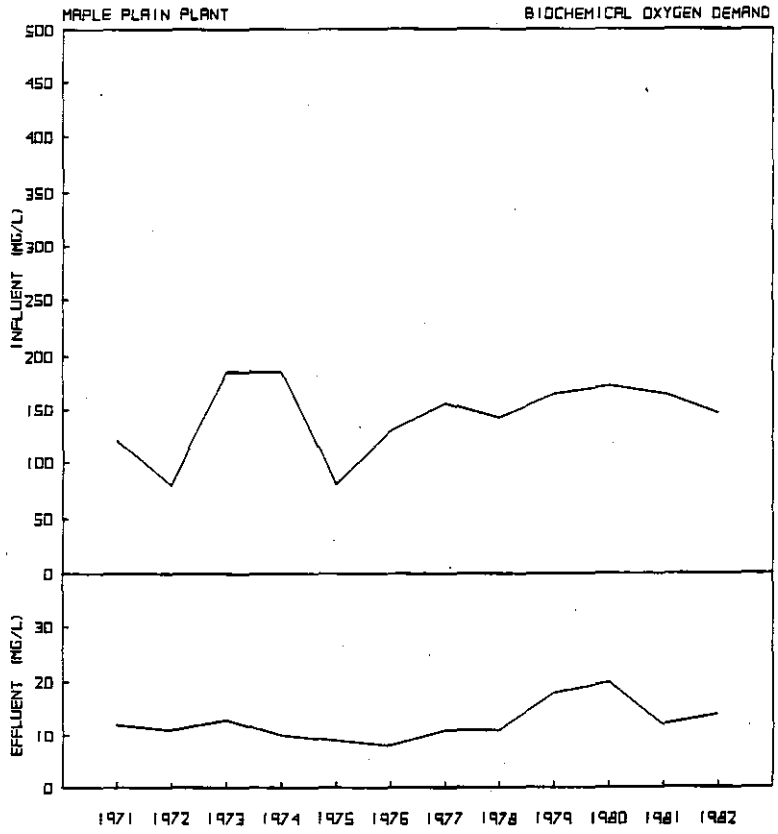


MONTHLY SUMMARY OF INFLUENT QUALITY
TREATMENT PLANT: Maple Plain

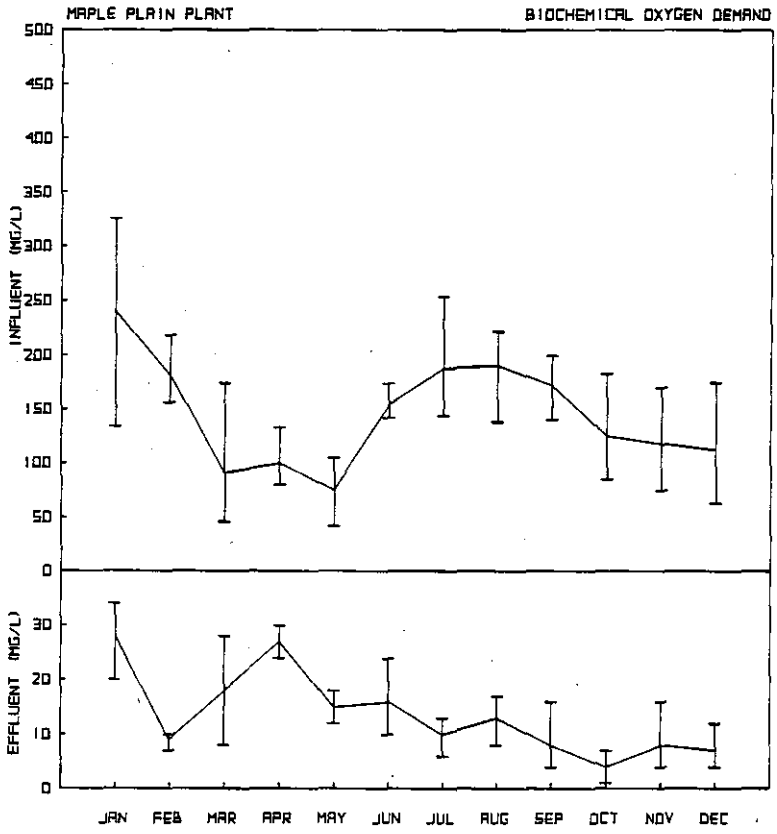
Month	Wastewater Flow, MGD	Temperature °C	TBOD mg/l	TSS mg/l	pH Range	KJN mg/l	Total-P mg/l	NH_3 mg/l	COD mg/l
JANUARY	0.20	12	240	597	7.6-7.8	62.9	10.5	27.6	653
FEBRUARY	0.24	11	181	168	7.7-7.8	52.0	7.5	22.1	399
MARCH	0.47	11	91	72	7.7-7.9	23.0	2.7	10.4	173
APRIL	0.59	12	100	90	7.7-7.8	25.4	3.4	7.7	156
MAY	0.58	12	75	86	7.7-7.8	23.7	3.2	9.5	171
JUNE	0.32	13	154	129	6.9-7.8	38.8	5.2	21.4	279
JULY	0.26	16	188	496	7.0-7.6	39.7	6.3	20.6	378
AUGUST	0.24	17	191	157	6.9-7.4	45.3	8.3	29.7	372
SEPTEMBER	0.27	16	172	275	7.0-7.5	42.5	5.9	21.6	289
OCTOBER	0.29	15	125	135	7.1-7.5	41.1	5.2	16.8	287
NOVEMBER	0.41	13	118	118	7.2-7.4	30.8	3.9	14.1	245
DECEMBER	0.37	10	112	66	7.3-7.5	29.2	3.6	16.3	186
1982 AVERAGE	0.35	13	146	199	6.9-7.9	37.9	5.5	18.1	299
1981 AVERAGE	0.25	14	165	179	7.3-8.0	----	----	----	274

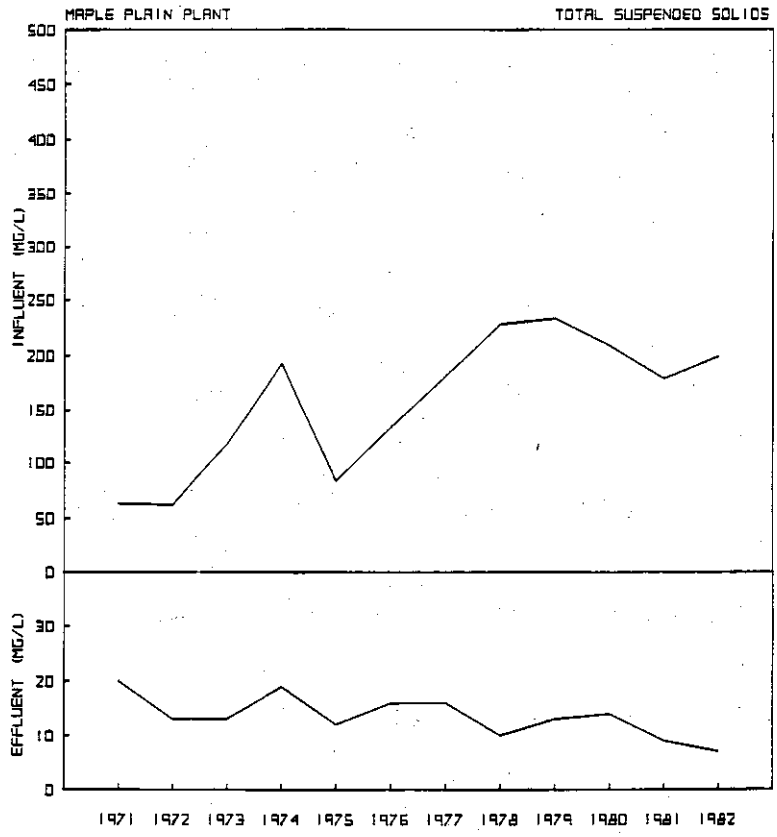
MONTHLY SUMMARY OF EFFLUENT QUALITY
TREATMENT PLANT: Maple Plain

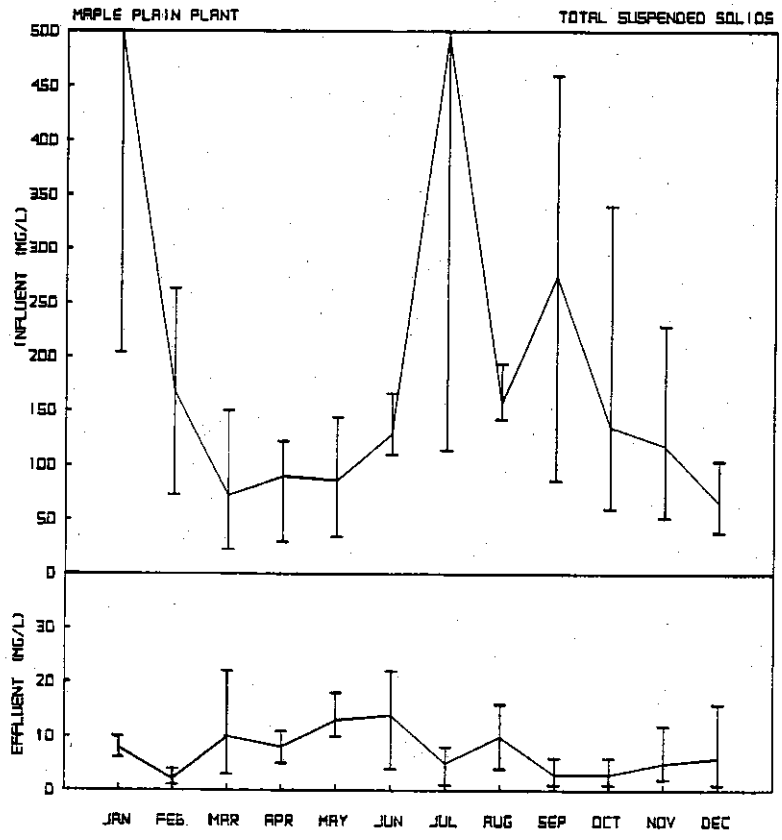
Month	TBOD mg/l	CBOD mg/l	COD mg/l	TSS mg/l	FECAL COLI Geo Mean no/100 ml	TURB NTU	KJN mg/l	NH_3 mg/l	NO_2 mg/l	NO_3 mg/l	Total P mg/l	Cl2 Used lbs	Cl2 Res mg/l	DO mg/l	pH Range	% Removal BOD	% Removal TSS
NPDES LIMIT	25	25	--	30	200	--	----	----	----	----	---	--	---	---	6.5-8.5	--	--
JANUARY	29	28	87	8	---	13	28.9	20.9	0.01	0.10	4.1	--	---	5.6	7.5-7.8	89	99
FEBRUARY	9	9	55	2	---	4	29.8	22.1	0.05	0.14	2.9	--	---	5.5	7.5-7.7	95	99
MARCH	18	18	65	10	13	10	15.4	11.0	0.07	0.94	2.2	26	0.3	5.8	7.5-7.8	80	86
APRIL	28	27	82	8	1	12	11.2	6.5	0.07	1.51	1.9	50	1.0	6.8	7.5-7.9	74	91
MAY	15	15	52	13	3	7	11.8	8.1	0.18	0.38	1.9	50	0.6	6.8	7.6-7.9	80	85
JUNE	19	16	70	14	24	11	19.0	12.7	0.02	0.07	2.7	47	0.0	4.1	7.5-7.8	90	89
JULY	12	10	48	5	63	9	24.5	17.6	0.01	0.18	3.8	24	0.0	5.3	7.5-7.8	95	99
AUGUST	15	13	59	10	1	23	27.4	19.3	0.01	0.06	4.1	30	0.0	5.1	7.4-7.7	93	93
SEPTEMBER	9	8	37	3	7	6	22.7	15.1	0.01	0.05	3.2	30	0.0	5.4	7.5-7.8	95	99
OCTOBER	5	4	33	3	1	3	14.7	9.1	0.20	1.14	2.6	30	0.0	5.7	7.5-7.7	97	98
NOVEMBER	10	8	33	5	---	3	12.7	9.2	0.19	2.06	2.3	--	---	6.6	7.5-7.6	93	96
DECEMBER	9	7	35	6	---	3	13.8	11.2	0.10	0.90	2.3	--	---	6.5	7.5-7.7	93	91
1982 AVG.	15	13	55	7	14	9	19.3	13.6	0.08	0.63	2.8	36	0.2	5.8	7.4-7.9	90	94
1981 AVG.	12	--	50	9	23	5	15.4	11.2	0.17	2.05	3.4	13	0.3	5.6	7.3-8.1	93	95

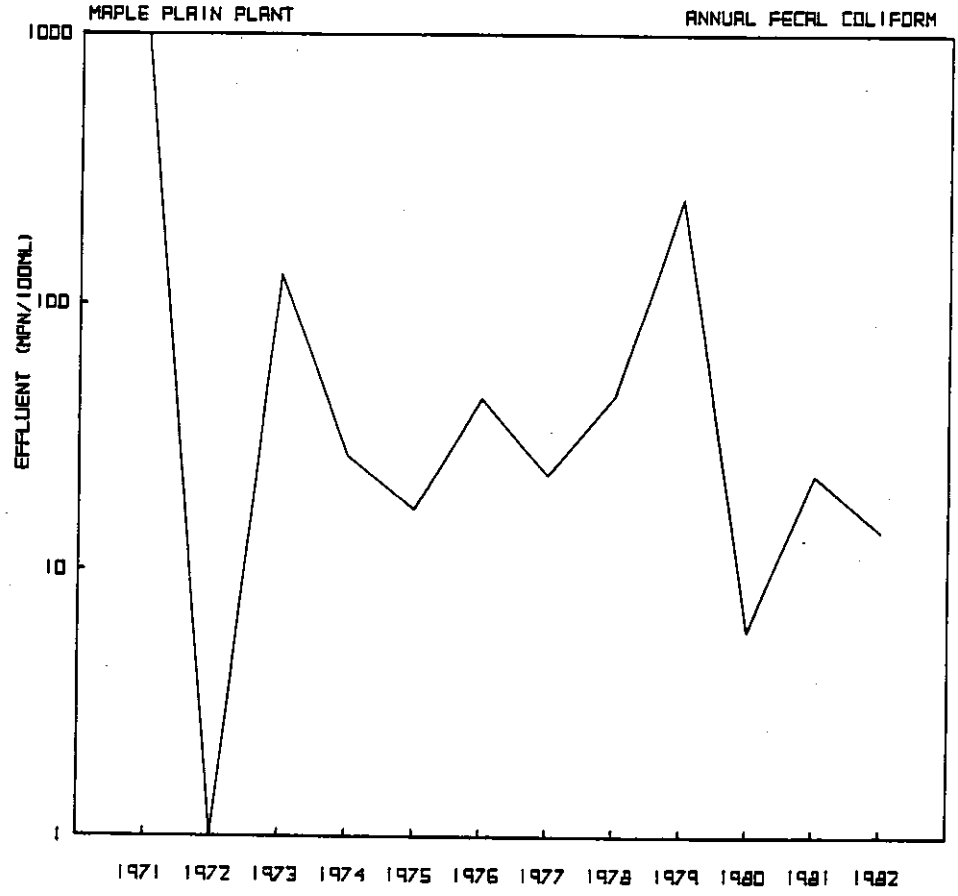


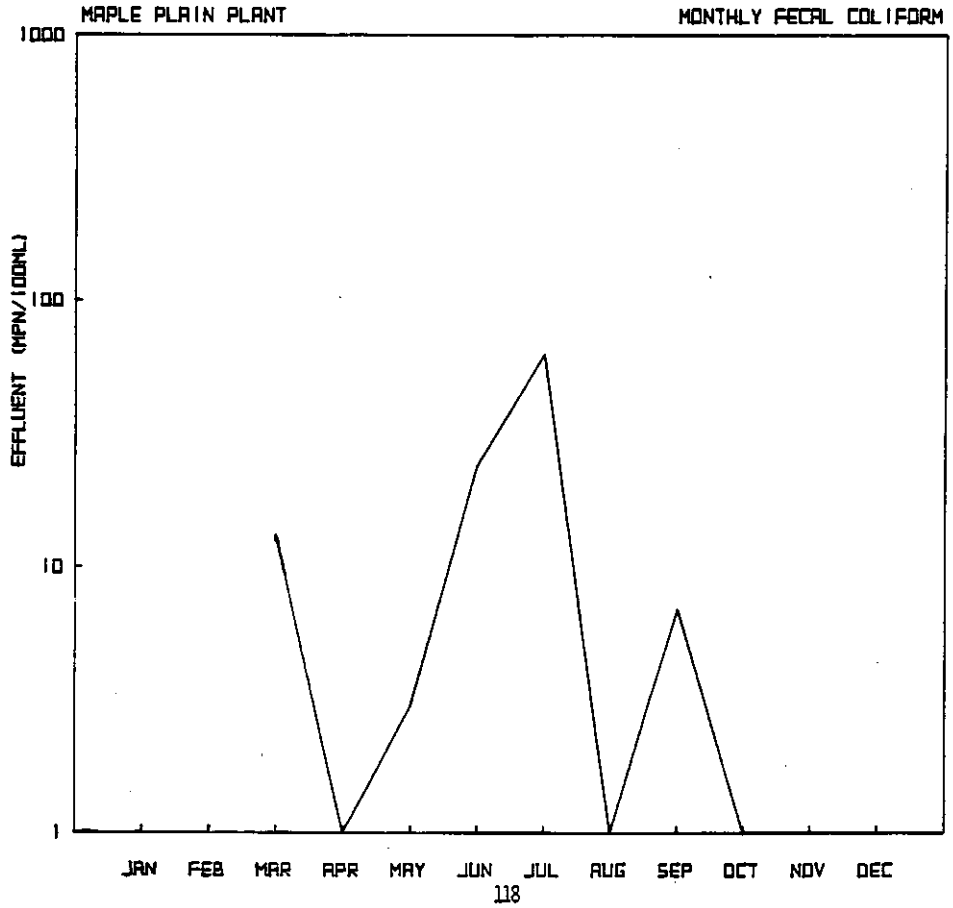
DATA REPRESENTS CBOD IN 1982. ALL PREVIOUS YEAR'S DATA ARE TBOD.

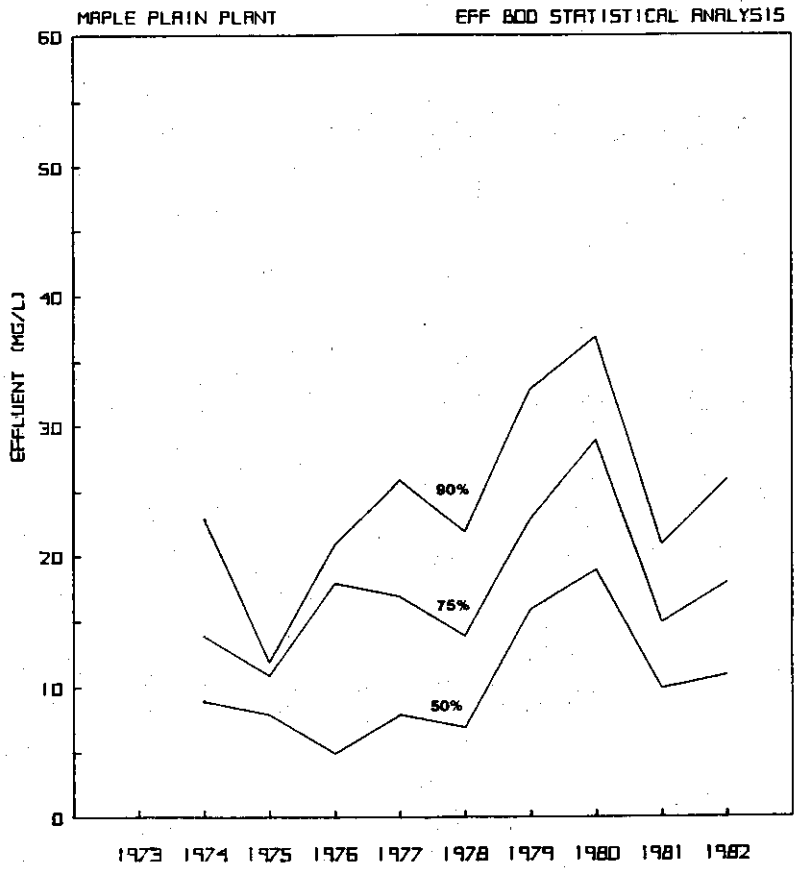


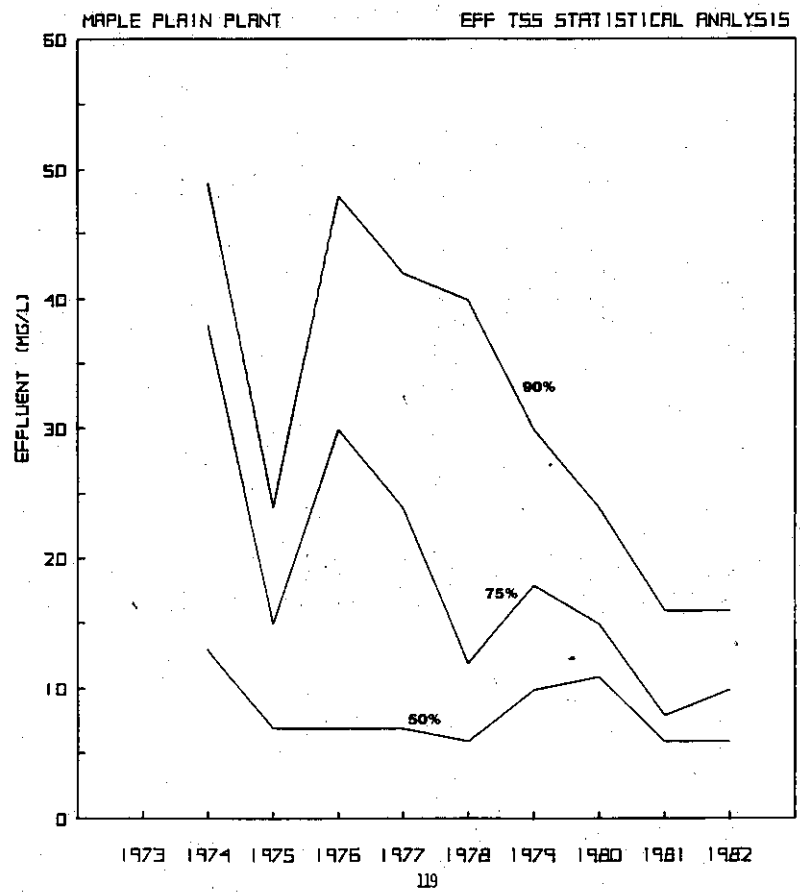

MAPLE PLAIN PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
EFFLUENT (MG/L)
30
20
10
0
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982


MAPLE PLAIN PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
EFFLUENT (MG/L)
30
20
10
0
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


MAPLE PLAIN PLANT
ANNUAL FECAL COLIFORM
EFFLUENT (MPN/100ML)
1000
100
10
1
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982


MAPLE PLAIN PLANT
MONTHLY FECAL COLIFORM
EFFLUENT (MPN/100ML)
1000
100
10
1
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC


MAPLE PLAIN PLANT
EFF BOD STATISTICAL ANALYSIS
EFFLUENT (MG/L)
60
50
40
30
20
10
0
90%
75%
50%
1973 1974 1975 1976 1977 1978 1979 1980 1981 1982


MAPLE PLAIN PLANT
EFF TSS STATISTICAL ANALYSIS
EFFLUENT (MG/L)
60
50
40
30
20
10
0
90%
75%
50%
1973 1974 1975 1976 1977 1978 1979 1980 1981 1982

MEDINA WASTEWATER TREATMENT PLANT

Plant History and Description

The Medina Plant was designed by W.T. Mills, and constructed in 1969. The plant serves the Hamel area and the City of Medina and has a design capacity of 0.10 mgd. The plant consists of a two-staged aerated lagoon system followed by two seepage ponds. The seepage pond contents are emptied by evaporation, percolation, and controlled discharge to nearby Elm Creek, when necessary.

Performance

Plant flow averaged 0.149 mgd in 1982, slightly greater than 0.104 mgd in 1981. Average aeration pond effluent quality was 14 mg/L BOD and 14 mg/L TSS, representing removal rates of 87 percent for BOD and 88 percent for TSS. The plant is presently operating at about 125 percent of its rated design capacity. Major problems with the seepage pond operation have been experienced since the fall of 1981 when the ponds overflowed their dikes. The Commission applied for, and received on November 1, 1982, a revised NPDES Permit which allows for controlled discharge directly to Elm Creek. The plant is subject to inflow/infiltration.

Future

The Medina Plant is scheduled to be phased out of operation in December, 1984, by construction of an interceptor sewer through the City of Plymouth and into the Metropolitan Plant collection system. The newly issued NPDES Permit requires plant phaseout by the end of 1984.

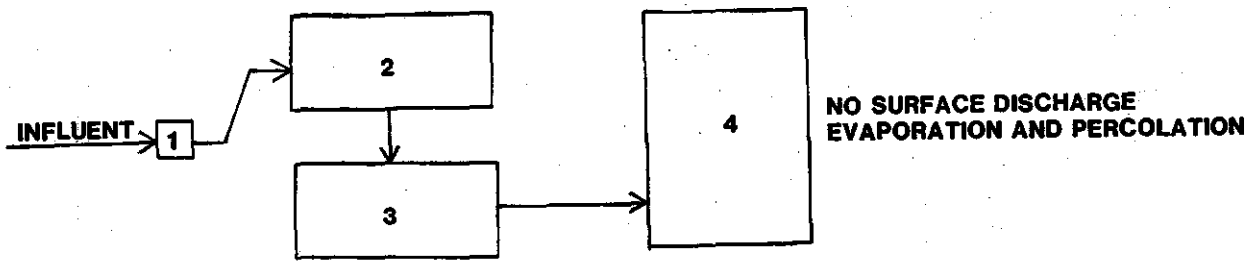
MEDINA PLANT PROCESS UNIT LOADINGS
1982

Parameter	Annual Average	Maximum Month
Wastewater Flow, MGD	0.132	0.224
BOD_5 Loading, lb/day	135	360
TSS Loading, lb/day	140	490
COD Loading, lb/day	255	300
Primary Aeration Pond		
Detention Time, Days	12.5	7.4
BOD_5, lb/Day/1000 Cu. Ft.	0.6	1.6
Final Aeration Pond		
Detention Time, Days	12.5	7.4
Seepage Ponds		
Detention Time, Days*	72	42
BOD_5 Loading, lb/acre/day	1.8	3.7

*Calculated assuming zero percolation and evaporation.

MEDINA WASTEWATER TREATMENT PLANT

FLOW DIAGRAM



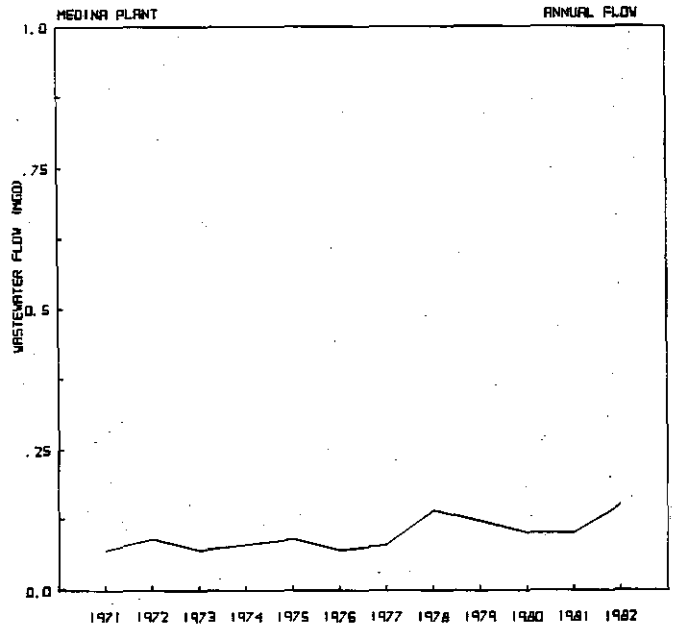
Unit Description

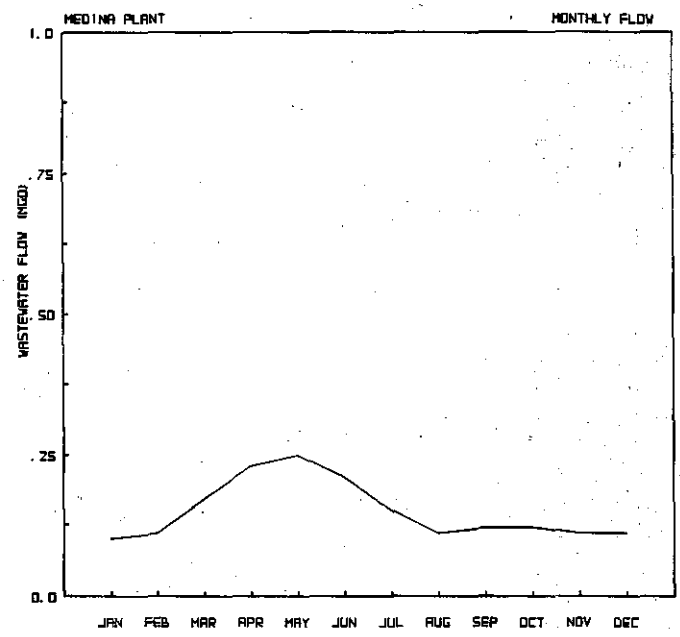
Liquid Phase

1. Screening
2. Primary Aerated Pond
3. Final Aerated Pond
4. Absorption Pond

Legend

- Liquid Flow
- Solids Transfer
- Existing Process Units
- Future Process Units



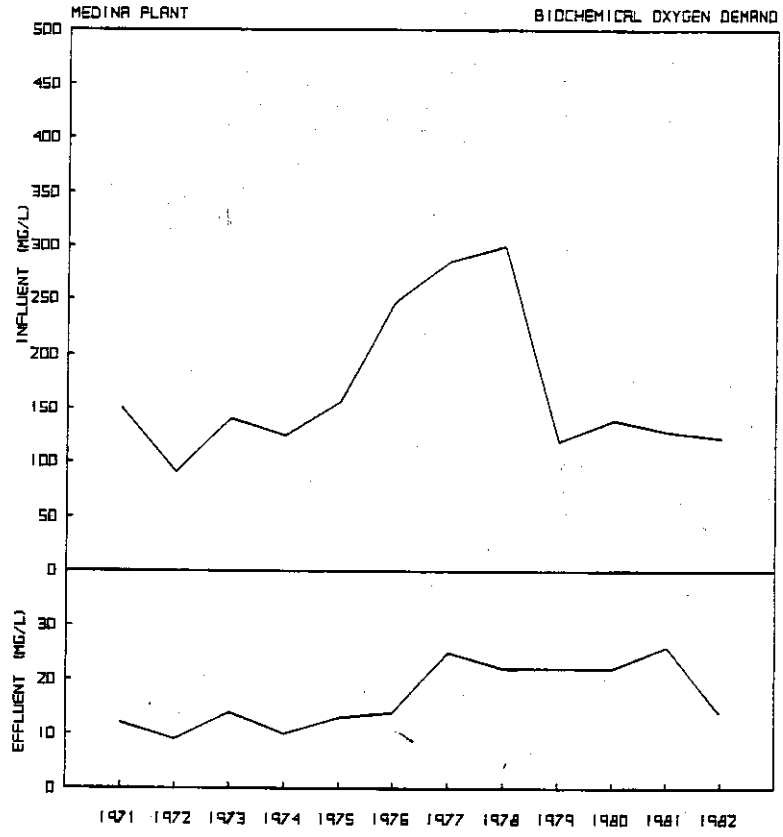


MONTHLY SUMMARY OF INFLUENT QUALITY
TREATMENT PLANT: Medina

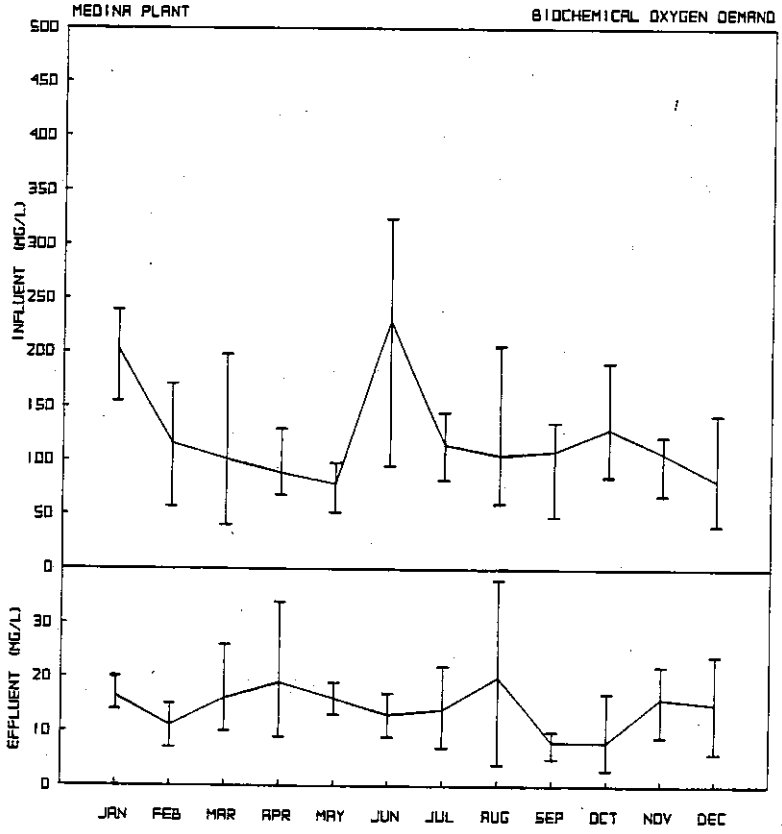
Month	Wastewater Flow, MGD	Temperature °C	TBOD mg/l	TSS mg/l	pH Range	KJN mg/l	Total-P mg/l	NH_3 mg/l	COD mg/l
JANUARY	0.095	12	203	224	7.6-7.7	59.0	7.8	27.2	408
FEBRUARY	0.115	12	116	111	7.7-7.8	48.5	5.5	20.1	255
MARCH	0.173	12	101	106	7.8-7.8	24.4	3.0	12.0	197
APRIL	0.228	12	88	97	7.7-7.9	15.0	2.9	5.6	155
MAY	0.255	12	78	173	7.7-7.8	15.4	3.5	5.3	208
JUNE	0.212	13	229	194	7.6-7.8	31.8	4.5	12.8	315
JULY	0.150	15	115	84	7.6-7.7	25.6	3.2	13.9	201
AUGUST	0.111	16	105	136	7.5-7.7	25.8	3.5	11.6	195
SEPTEMBER	0.117	15	109	91	7.5-7.7	35.5	4.2	17.4	222
OCTOBER	0.116	14	130	124	7.5-7.6	42.2	4.8	17.1	242
NOVEMBER	0.106	--	107	99	--------	28.9	3.5	12.6	203
DECEMBER	0.113	--	81	80	--------	28.2	3.5	16.2	173
1982 AVERAGE	0.149	13	122	127	7.5-7.9	31.7	4.2	14.3	231
1981 AVERAGE	0.104	14	128	132	7.6-7.9	----	---	----	236

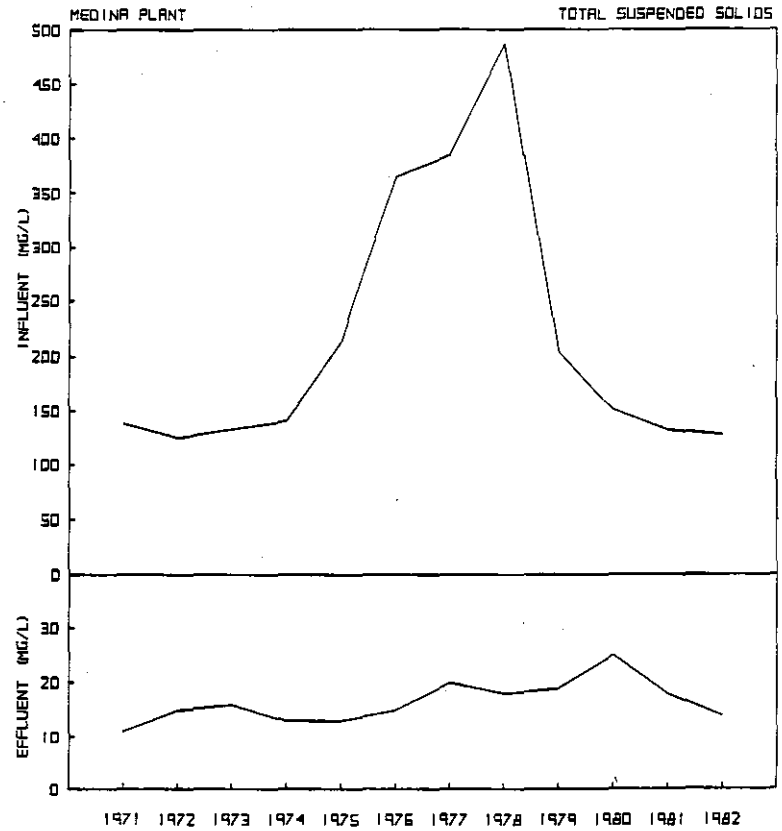
MONTHLY SUMMARY OF EFFLUENT QUALITY
TREATMENT PLANT: Medina

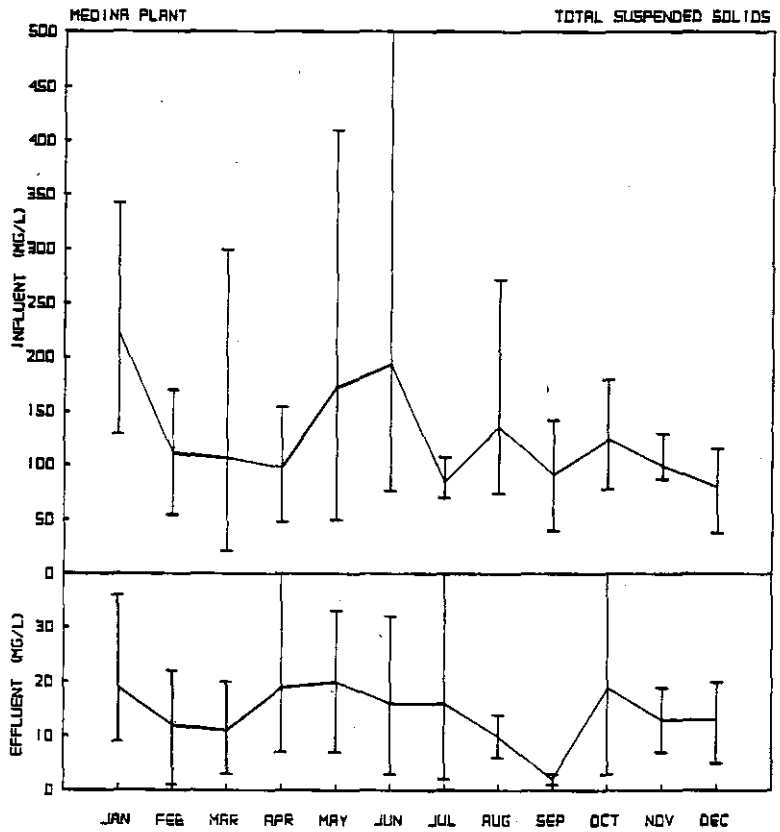
Month	TBOD mg/l	CBOD mg/l	COD mg/l	TSS mg/l	FECAL COLI Geo Mean no/100 ml	TURB NTU	KJN mg/l	NH_3 mg/l	NO_2 mg/l	NO_3 mg/l	Total P mg/l	Cl2 Used lbs	Cl2 Res mg/l	DO mg/l	pH Range	% Removal BOD	% Removal TSS
JANUARY	19	17	84	19	--	12	25.0	18.3	0.02	0.10	3.5	---	---	3.0	7.5-7.7	92	91
FEBRUARY	11	11	67	12	--	7	24.9	17.6	0.03	0.16	2.8	---	---	3.1	7.6-7.7	91	89
MARCH	12	16	92	11	--	9	17.9	8.7	0.23	0.61	3.0	---	---	3.1	7.5-7.8	84	90
APRIL	20	19	65	19	--	10	10.6	5.8	0.18	0.51	1.1	---	---	5.1	7.8-7.8	79	80
MAY	24	16	61	20	--	8	10.8	5.2	0.25	0.37	2.0	---	---	4.2	7.6-7.8	80	89
JUNE	17	13	62	16	--	9	15.4	10.1	0.03	0.09	2.3	---	---	2.8	7.6-7.8	94	92
JULY	17	14	62	16	--	10	22.5	13.0	0.09	0.19	3.3	---	---	3.1	7.4-7.8	88	81
AUGUST	11	20	60	10	--	9	20.5	13.8	0.15	0.09	4.1	---	---	3.7	7.5-7.7	81	92
SEPTEMBER	8	8	36	2	--	5	22.6	15.6	0.02	0.05	3.6	---	---	3.4	7.5-7.7	93	98
OCTOBER	19	8	47	19	--	4	14.3	7.8	0.13	1.53	2.8	---	---	3.1	7.4-7.6	94	84
NOVEMBER	21	16	46	13	--	5	12.4	8.4	0.14	1.20	1.7	---	---	2.9	7.4-7.5	86	87
DECEMBER	26	15	51	13	--	6	15.2	12.1	0.10	0.85	2.3	---	---	2.9	7.3-7.4	81	84
1982 AVG.	17	14	61	14	--	8	17.7	11.4	0.12	0.48	2.7	---	---	3.4	7.3-7.8	87	88
1981 AVG.	26	--	65	18	--	9	13.4	8.2	0.31	0.57	3.2	---	---	3.4	6.5-7.9	80	86



DATA REPRESENTS CBOD IN 1982. ALL PREVIOUS YEAR'S DATA ARE TBOD.




MEDINA PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
EFFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
30
20
10
0
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982


MEDINA PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
EFFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
30
20
10
0
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

METROPOLITAN WASTEWATER TREATMENT PLANT

Plant History and Description

The existing Metropolitan Plant has been constructed in several stages. The original 1938 primary treatment was designed on the basis of an average annual wastewater flow of 134 mgd. It included pretreatment by screening and grit removal, primary treatment by sedimentation, intermediate treatment by chemical precipitation, effluent filtration and chlorination. The sludge disposal system included chemical conditioning (lime and ferric chloride), vacuum filtration, incineration, and land disposal of ash.

In the early 1960's, construction was initiated on the second stage of the plant. In 1966, the secondary treatment portion of the plant was placed into operation. This expansion was based on an annual average flow of 218 mgd and was designed to operate as a high rate activated sludge process. It consisted of four aeration tanks, three aeration compressors, twelve final sedimentation tanks, additional chlorination facilities, and a new chlorine contact effluent channel. The original sludge disposal system was expanded by construction of new gravity sludge thickeners, sludge holding tanks, and additional chemical conditioning, vacuum filtration and incineration facilities.

Stage Three was placed into operation in 1972. This phase added four more aeration tanks and two more air compressors to provide enough capacity to operate the step aeration activated sludge process. Incremental feed pipes were required as modification to the original aeration tanks. This completed the West Battery activated sludge system. One new incinerator was also constructed during this time to allow additional sludge disposal capacity.

By the mid 1970's, the fourth stage of construction was initiated to meet the following objectives: (1) to protect the plant from flood damage; (2) to maintain full secondary treatment during flood periods; (3) to provide a minimum of primary treatment and disinfection for all dry and wet weather flows that reached the plant; (4) to provide secondary treatment capacity based on secondary treatment standards as defined by the 1972 Water Pollution Control Act Ammendments (PL92-500); (5) to provide solids processing capacity to handle the increased sludge generated by the liquid treatment expansion; and (6) to minimize energy consumption for solids processing at the plant.

By 1978, the bulk of the liquid treatment construction program had been completed. Completed projects included the flood protection facility, effluent pumping station, east battery pretreatment (screening and grit removal), east battery primary settling tanks and east battery aeration and final settling tanks.

By 1980, the first portion of the solids processing facilities was completed. These projects included floatation thickening for secondary sludge, sludge storage, thermal conditioning, return liquor treatment facilities and filter press dewatering. The sludge incineration and energy recovery

facilities were behind schedule at this time. To meet air pollution control requirements, scrubbers were installed on the F & I No. 1 incinerators. Further, to allow temporary shutdown of F & I No. 2 incinerators, an interim land disposal program was implemented. This required construction of sludge loadout facilities and asphalt sludge storage pads and composting area.

The remaining solids processing facilities were nearing completion and had begun the start-up phase by late 1982. These projects include the roll presses for primary sludge dewatering, the four modified F & I No. 2 sludge incinerators, sludge dryers, energy recovery facilities, air pollution control facilities, and the distributed digital acquisition and control system.

On December 14, 1982, the MPCA approved a new five-year permit for the Metropolitan Plant as a reissuance of the old permit which expired on June 30, 1982. Whereas, the old NPDES Permit contained provisions to attain and maintain compliance with secondary treatment standards, the new permit considered effluent limitations and compliance schedules to meet water quality standards for the Mississippi River. The new permit, retroactive to July 1, 1982, immediately resulted in the following changes to effluent limitations:

1. Effluent BOD limitations change from 25 mg/L to 24 mg/L. The effluent BOD limitations now applies to CBOD rather than TBOD;

2. A turbidity limitation of 25 NTU is required;

3. A minimum dissolved oxygen limitation of 7 mg/L for river flows less than 7,000 cfs and river DO values less than 6.0 mg/L upstream, and less than 5.5 mg/L downstream during the period June through September;

4. Interim limitations on cyanide, cadmium, copper, and mercury.

All of the above limitations are presently being met under existing conditions. Meeting dissolved oxygen limitations requires that the effluent pumping station be operated as necessary to increase the dissolved oxygen of the effluent.

In June, 1985, advanced secondary treatment standards become applicable upon completion of the East Battery Expansion. The effluent CBOD limitations decreases to 18 mg/L as a monthly average, and 36 mg/L as a weekly (7-consecutive day) average for the summer months. A monthly effluent limitation on ammonia nitrogen of 8 mg/L becomes effective for the summer months.

On January 1, 1986, final effluent limitations for cyanide, cadmium, copper, and mercury become applicable and on June 1, 1986, an effluent chlorine residual limitation of 0.026 mg/L must be achieved and maintained.

Effluent CBOD limits scheduled for 1985 were met during the summer months of 1982 and, in August, 1982, the future ammonia limitation was met when biological ammonia removal was provided in the east secondary treatment facilities. Completion of the East Battery Expansion should provide greater treatment reliability and the industrial pretreatment program will assist in providing compliance with cyanide and metals limitations. Addition of effluent dechlorination facilities or an alternate method of disinfection must be implemented to achieve compliance with future chlorine residual limitations.

Performance

Plant flow averaged 208 mgd in 1982, somewhat higher than 202 mgd in 1981. Effluent quality during 1982 improved from that of 1981. Average effluent BOD and TSS concentrations during 1982 were 13 mg/L and 11 mg/L as compared to 1981 average effluent BOD and TSS values of 19 mg/L and 19 mg/L. This is the third consecutive year that the Metropolitan Plant performance has shown improvement. This improvement becomes significant when 82 percent of all wastewater generated in the Metropolitan Area is treated to this level. Statistical analysis of data show the following trend in effluent BOD and TSS from 1979 through 1982.'

Effluent Concentration, mg/l

	50% of Time				75% of Time				90% of Time			
	1979	1980	1981	1982	1979	1980	1981	1982	1979	1980	1981	1982
BOD	30	20	14	10	53	29	24	15	71	44	36	22
TSS	43	15	10	7	85	33	24	12	137	60	47	21

Future

The Metropolitan Plant will continue to be the largest treatment facility in the Metropolitan Disposal System. Construction of additional aeration and final sedimentation tanks for the East Battery activated sludge system is underway and is expected to be completed in early 1985. Future projects include: (1) disinfection improvements or changes to meet a chlorine residual standard by 1986; (2) retrofit of existing facilities to be compatible with the distributed digital acquisition and control system; and (3) rehabilitation of older plant systems such as west pretreatment, west primary, west secondary, etc.

METROPOLITAN PLANT PROCESS UNIT LOADINGS
1982

Parameter	Annual Average	Maximum Month
Wastewater Flow, MGD	208	239
Flow-East, MGD (1)	176	204
Flow-West, MGD (2)	32	35
BOD Loading, lb/day	350,000	440,000
TSS Loading, lb/day	420,000	600,000
Primary Sludge, ton/day	184	220
Secondary Sludge, ton/day	114	140
Total Sludge (with recycle), ton/day	298	360
Bar Screens		
East Battery		
No. of Units	4.2	4.8
Unit Flow, MGD	42	42
West Battery		
No. of Units	0.6	0.7
Unit Flow, MGD	50	50
Grit Tanks		
East Battery		
No. of Units	4.2	4.8
Hor. Velocity, fps	0.4	0.4
Unit Flow, MGD	42	42
West Battery		
No. of Units	1.2	1.4
Hor. Velocity, fps	1.0	1.0
Unit Flow, MGD	25	25
Primary Sedimentation		
East Battery		
No. of Units	7.9	8.0
Detention Time, Hr.	3.0	2.6
Overflow Rate, gpd/Sq. Ft.	930	1,060
West Battery		
No. of Units	5.6	4.9
Detention Time, Hr.	8.0	6.4
Overflow Rate, gpd/Sq. Ft.	350	440
Activated Sludge-Aeration		
East Battery		
Flow, MGD	97	112
No. of Units	3.8	4.0
F:M Ratio, day^{-1}	0.22	0.27

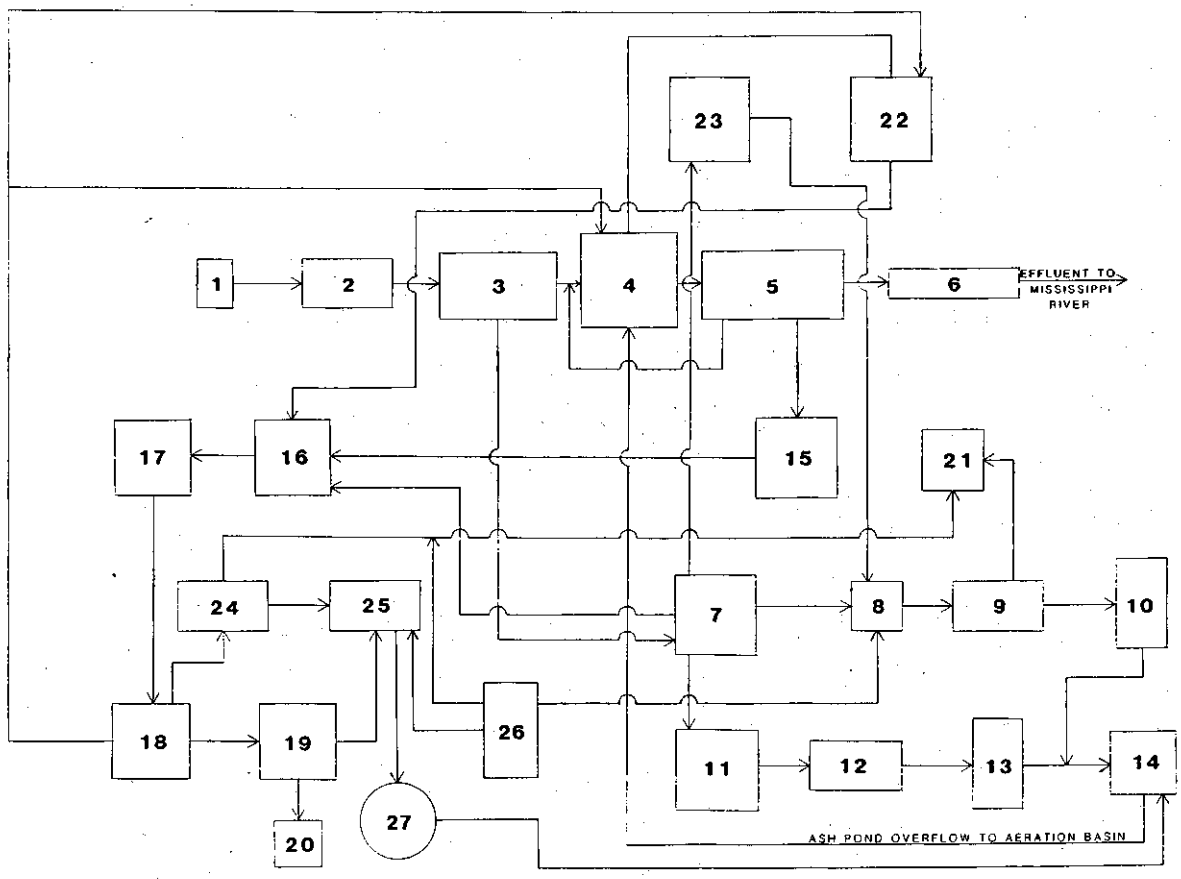
Parameter	Annual Average	Maximum Month
BOD Load, lb/Day/1000 Cu. Ft.	47	62
Air Use, Cu. Ft./lb. BOD	1,700	2,600
Detention Time, Hr.	4.7	4.3
West Battery		
Flow, MGD	111	127
No. of Units	4.0	4.3
F:M Ratio, day^{-1}	0.23	0.30
BOD Load, lb/Day/1000 Cu. Ft.	49	59
Air Use, cf/lb. BOD	1,800	2,100
Detention Time, Hr.	4.3	4.0
Final Sedimentation		
East Battery		
No. of Units	8.8	9.0
Detention Time, Hr.	3.5	3.1
Overflow Rate, gpd/Sq. Ft.	560	630
Solids Load, psf/day	10	14
West Battery		
No. of Units	11.6	12.0
Detention Time, Hr.	4.0	3.6
Overflow Rate, gpd/Sq. Ft.	490	540
Solids Load, psf/day	9	11
Chlorination		
Chlorine Use, lb/day (3)	8,500	14,000
Chlorine Dose, mg/L (3)	4.6	7.3
Contact Time, Minutes	28	24
Gravity Thickening		
Solids Loading, psf/day	20	26
Overflow Rate, gpd/Sq. Ft.	430	470
Sludge Concentration, % TS	6.5	6.4
Flotation Thickening		
No. of Units	10.9	12.7
Solids Loading, psf/day	9.4	11
Air:Solids Ratio	0.03	0.03
Sludge Concentration, % TS	3.3	3.0
Thermal Conditioning		
No. of Units	3.0	3.6
Feed Concentration, % TSS	3.9	4.1
TSS Solubilization, %	42	46
Decant Tank Underflow, % TSS	14	14

Parameter	Annual Average	Maximum Month
Chemical Conditioning (4)		
Vacuum Filters (F & I No. 1)		
Lime Dose, % of D.S.S.	9	10
$FeCL_3$ Dose, % of D.S.S.	2.6	3.1
Vacuum Filters (F & I No. 2)		
Lime Dose, % of D.S.S.	27	38
$FeCL_3$ Dose, % of D.S.S.	11	15
Vacuum Filters		
F & I No. 1		
No. of Units	4.4	5.0
Filter Rate, psf/Hr. (5)	3.3	3.6
Cake Solids, % TS (6)	28	30
Dry Sludge, TPD	87	108
F & I No. 2		
No. of Uits	5.6	6.9
Filter Rate, psf/Hr. (5)	2.0	1.9
Cake Solids, % TS (6)	25	26
Dry Sludge, TPD	90	110
Filter Presses		
No. of Units	2.6	3.1
Dry Sludge, TPD	41	87
Cake Solids, % TS	48	45
Incineration		
F & I No. 1 (7)		
No. of Units	2.0	1.7
Auxiliary Fuel Use, MMBtu/TDS	6.5	5.8
Dry Sludge, TPD	73	108
Wet Loading, psf/Hr.	6.0	6.5
F & I No. 2 (8)		
No. of Units	---	---
Auxiliary Fuel Use, MMBtu/TDS	---	---
Dry Sludge, TPD	---	---
Wet Loading, psf/Hr.	---	---

NOTES:

(1) Flow to East Pretreatment and East Primary.
(2) Flow to West Pretreatment and West Primary.
(3) Average for months when disinfection was required, i.e. March-October, 1982.
(4) Polymer conditioning for roll presses is not shown, because these units began operation in late 1982.
(5) Filter rate is based on dry sludge solids.
(6) Cakes solids includes chemicals.
(7) Averages are based on months of operation, i.e. January-September, 1982.
(8) Incinerators in F & I No. 2 were shut down for modifications in March, 1981.

METROPOLITAN WASTEWATER TREATMENT PLANT
FLOW DIAGRAM

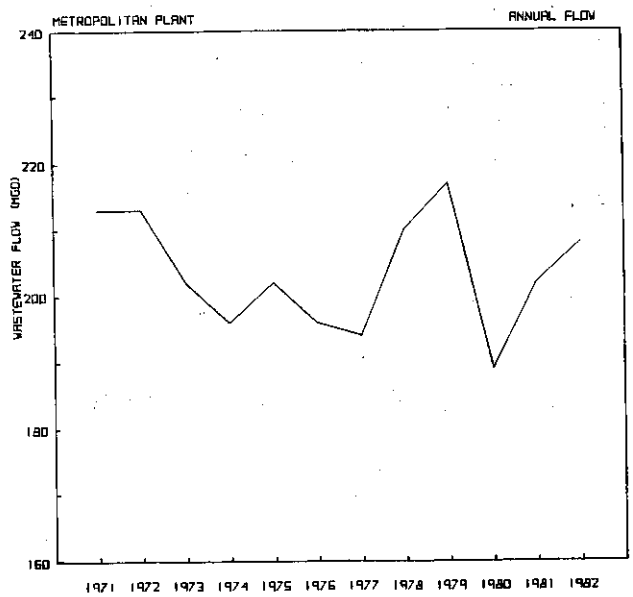


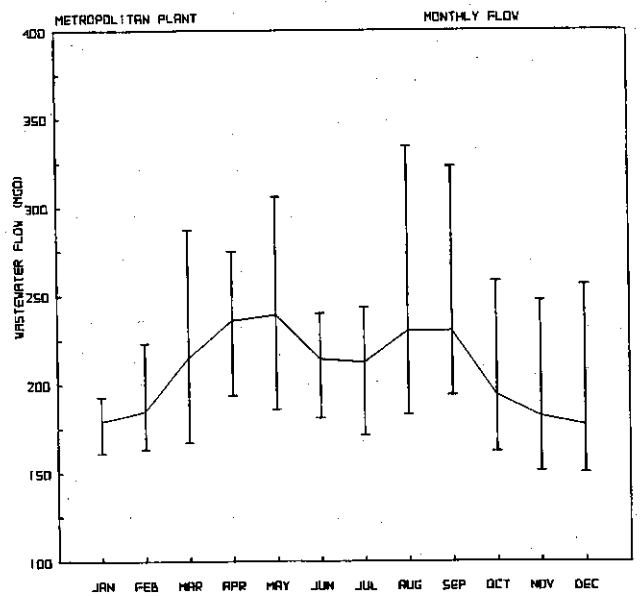
Liquid Phase

1. Screening
2. Grit Removal
3. Primary Sedimentation
4. Activated Sludge
5. Final Sedimentation
6. Chlorination

Solid Phase

7. Gravity Thickening
8. Holding Tank
9. Vacuum Filtration
10. Incineration
11. Concentration
12. Vacuum Filtration
13. Incineration
14. Ash Pond
15. Flotation Thickening
16. Sludge Storage
17. Thermal Conditioning
18. Decant Thickening
19. Plate & Frame Press
20. North Loadout
21. South Loadout
22. Return Liquors Bio.
23. Return Liquors P-Chem.
24. Vacuum Filter
25. Incinerator
26. Roll Press
27. Silos



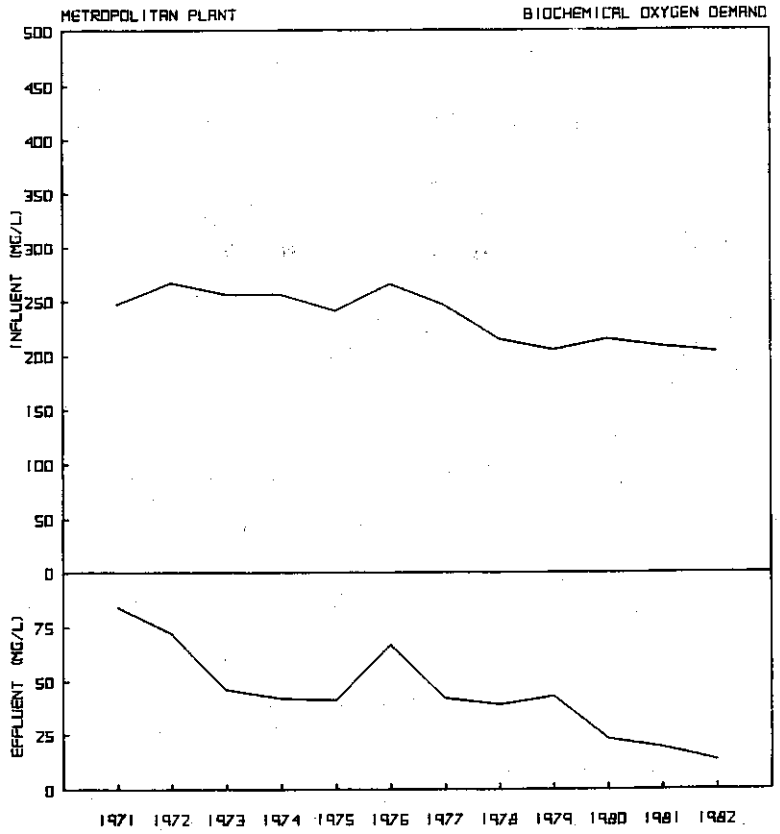


MONTHLY SUMMARY OF INFLUENT QUALITY
TREATMENT PLANT: Metropolitan

Month	Wastewater Flow, MGD	Temperature °C	TBOD mg/l	TSS mg/l	pH Range	KJN mg/l	Total-P mg/l	NH_3 mg/l	COD mg/l
JANUARY	179	13	215	239	6.2-8.4	----	---	----	441
FEBRUARY	185	13	214	253	6.5-7.7	----	---	----	438
MARCH	215	12	185	221	7.1-8.2	----	---	----	380
APRIL	236	12	171	194	7.1-7.6	----	---	----	375
MAY	239	15	169	229	7.0-9.4	----	---	----	344
JUNE	214	16	187	251	6.8-7.5	----	---	----	407
JULY	212	19	189	254	6.8-7.5	----	4.4	----	397
AUGUST	230	21	231	316	6.8-7.8	----	5.0	----	448
SEPTEMBER	230	21	217	277	6.8-7.5	----	4.7	16.1	448
OCTOBER	194	19	206	211	6.2-9.2	31.1	5.2	14.6	406
NOVEMBER	182	17	210	206	5.7-8.5	29.7	4.8	16.6	392
DECEMBER	177	15	246	245	6.6-8.7	30.9	5.2	18.2	499
1982 AVERAGE	208	16	203	241	5.7-9.4	30.6	4.9	16.4	415
1981 AVERAGE	202	17	208	230	5.4-9.0	----	---	----	413

MONTHLY SUMMARY OF EFFLUENT QUALITY
TREATMENT PLANT: Metropolitan

Month	TBOD mg/l	CBOD mg/l	COD mg/l	TSS mg/l	FECAL COLI Geo Mean no/100 ml	TURB NTU	KJN mg/l	NH_3 mg/l	NO_2 mg/l	NO_3 mg/l	Total P mg/l	C12 Used lbs	C12 Res mg/l	DO mg/l	pH Range	% Removal BOD	% Removal TSS
NPDES LIMIT	24	24	---	30	200	--	----	----	----	----	---	----	---	---	6.5-8.5	--	--
JANUARY	27	14	62	7	---	4	21.5	15.5	0.87	4.45	2.0	----	---	2.6	7.3-8.1	93	97
FEBRUARY	30	19	85	19	---	7	22.9	14.8	0.62	3.40	2.4	----	---	2.7	7.2-8.3	91	93
MARCH	30	21	102	27	2	13	21.3	14.4	0.92	2.05	1.8	7252	2.0	3.8	7.2-8.1	89	88
APRIL	13	10	77	7	3	6	21.3	16.2	0.25	0.48	1.6	6953	1.7	3.4	7.2-8.1	94	96
MAY	18	10	73	8	8	5	20.0	14.4	0.69	0.24	1.3	5813	1.3	3.2	7.2-8.3	94	96
JUNE	31	18	99	17	32	11	23.1	15.1	1.44	0.17	2.1	6780	1.6	2.6	7.1-8.4	90	93
JULY	26	11	66	10	56	6	18.6	13.0	2.35	0.31	1.7	8594	2.6	2.9	7.1-8.2	94	96
AUGUST	15	8	55	4	13	4	12.9	7.7	1.88	3.98	2.2	14387	2.5	3.4	6.9-8.0	96	99
SEPTEMBER	17	11	73	11	20	7	20.9	13.6	0.78	1.65	1.9	9860	2.5	3.5	7.1-8.1	95	96
OCTOBER	21	11	81	8	62	5	24.1	15.7	0.86	0.32	2.1	8026	2.6	4.3	6.9-7.8	95	96
NOVEMBER	20	11	78	8	---	5	24.8	18.6	0.72	0.38	2.4	----	---	3.5	7.0-8.3	95	96
DECEMBER	20	11	75	8	---	3	24.4	19.5	0.55	1.49	2.2	----	---	1.7	7.1-7.6	96	97
1982 AVG.	22	13	77	11	24	6	21.3	14.9	0.99	1.58	2.0	8458	2.1	3.1	6.9-8.4	95	95
1981 AVG.	19	--	77	19	60	10	19.2	12.9	0.85	2.27	2.0	7823	2.2	2.6	6.6-8.3	91	92



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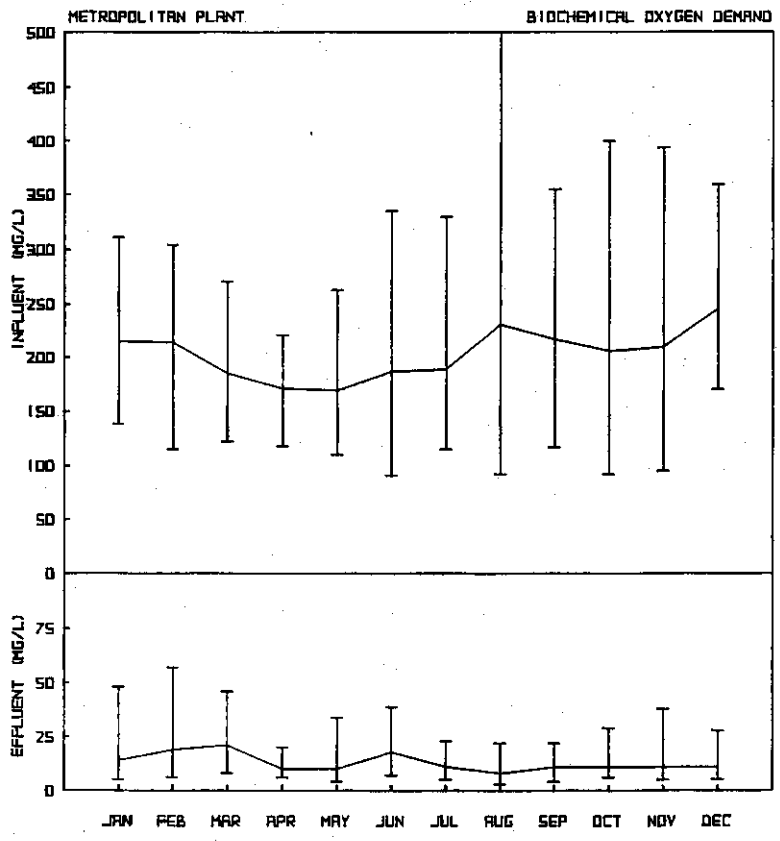
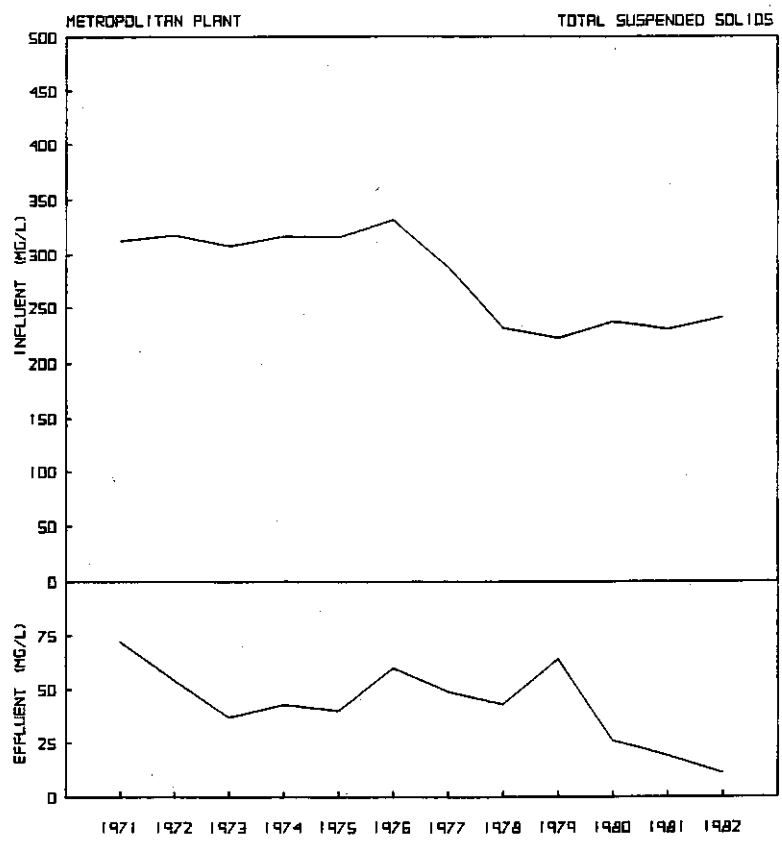
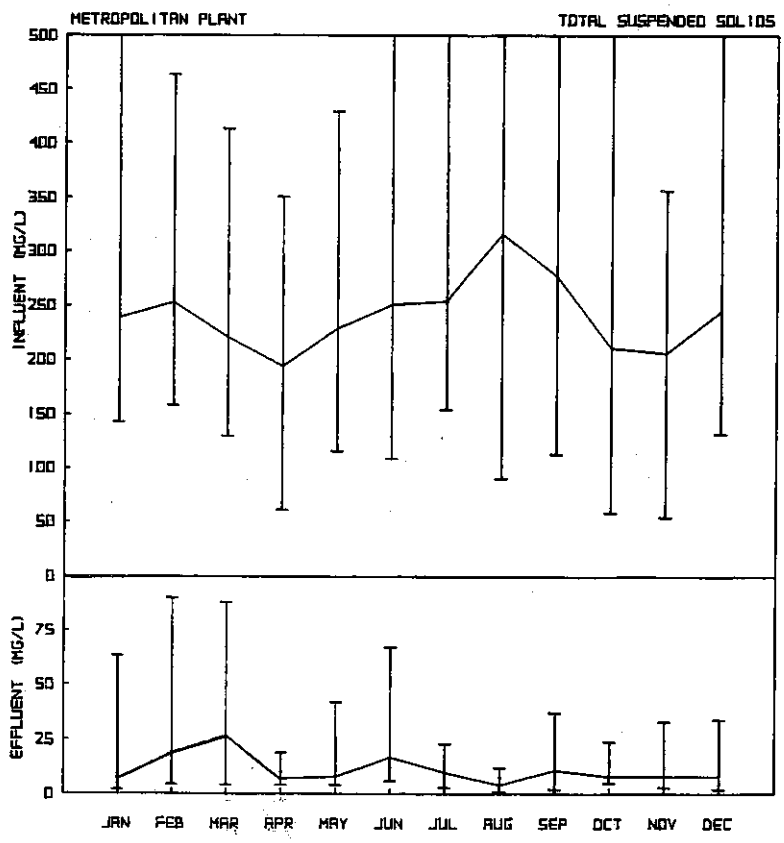
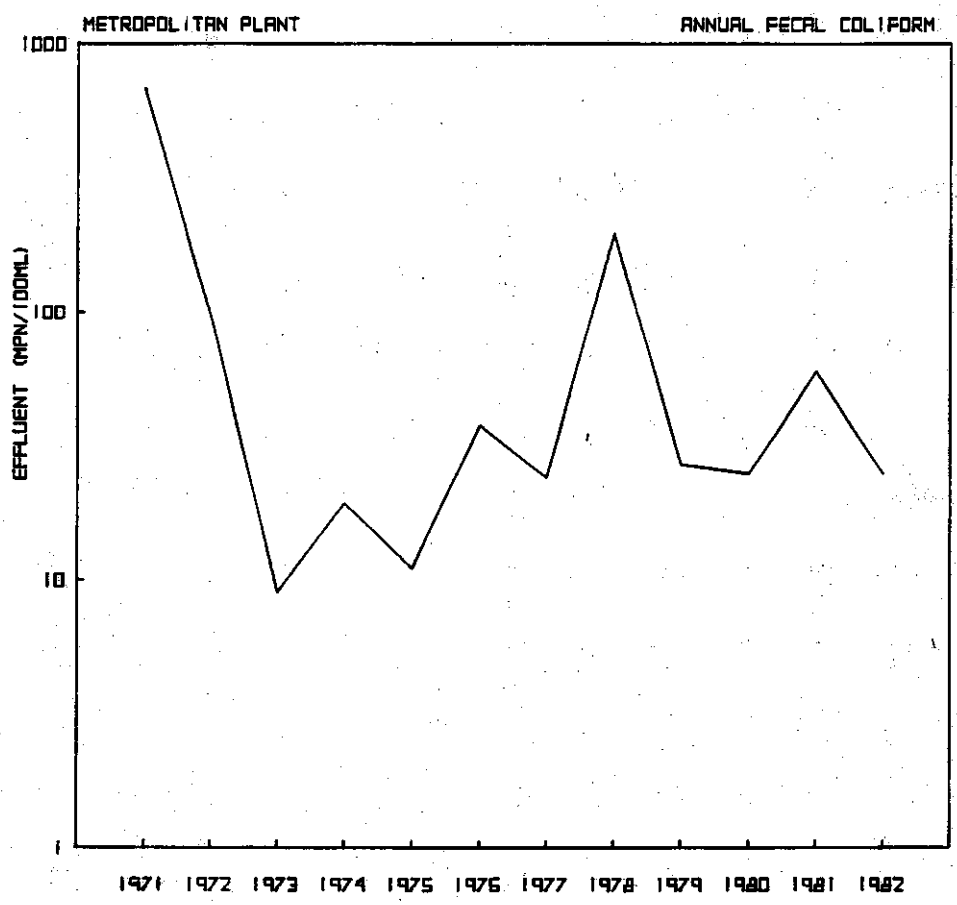



METROPOLITAN PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
EFFLUENT (MG/L)
75
50
25
0
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982


METROPOLITAN PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
EFFLUENT (MG/L)
75
50
25
0
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC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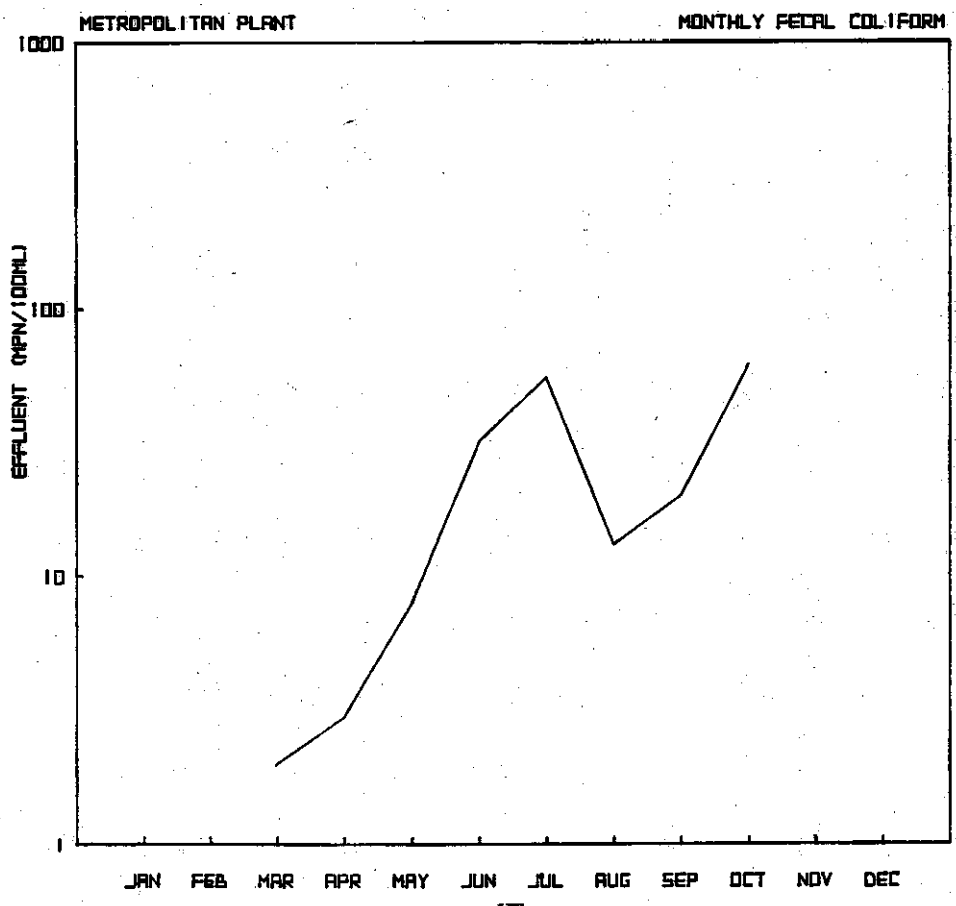
ANNUAL FECAL COLIFORM
1000
100
10
1
EFFLUENT (MPN/100ML)
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982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MONTHLY FECAL COLIFORM
1000
100
10
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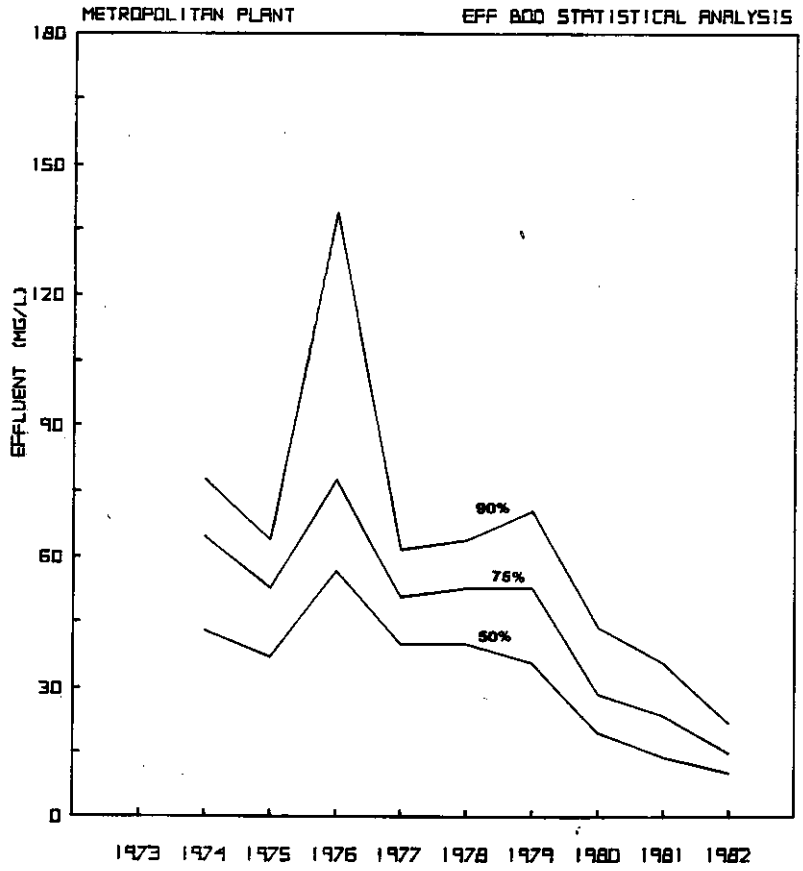
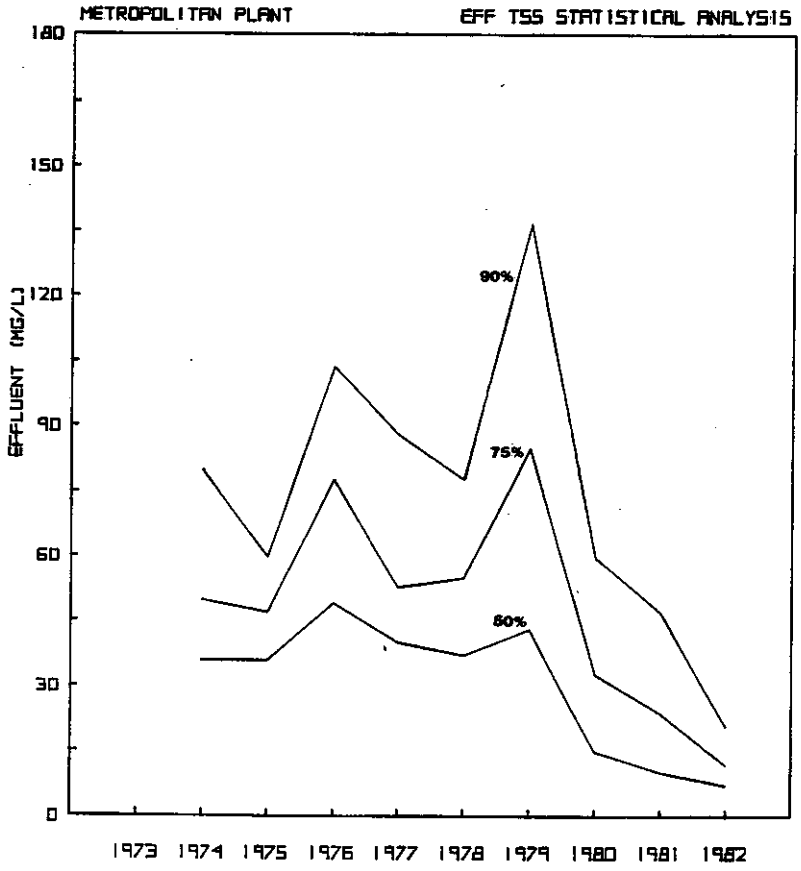
EFFLUENT (MPN/100ML)
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


METROPOLITAN PLANT
EFF BOD STATISTICAL ANALYSIS
EFFLUENT (MG/L)
180
150
120
90
60
30
0
90%
75%
50%
1973 1974 1975 1976 1977 1978 1979 1980 1981 1982


METROPOLITAN PLANT
EFF TSS STATISTICAL ANALYSIS
EFFLUENT (MG/L)
180
150
120
90
60
30
0
90%
75%
50%
1973 1974 1975 1976 1977 1978 1979 1980 1981 1982

1982 EFFLUENT DATA
TREATMENT PLANT Metropolitan

MONTH	Cu mg/l	Cr mg/l	Zn mg/l	Pb mg/l	Cd mg/l	Hg ug/l	CN mg/l	As ug/l	Sn mg/l	Ni mg/l	Phenol ug/l	Fe mg/l	PCB ug/l
NPDES Limit*	0.140				0.030	4.0	0.193						
January	<0.03	<0.05	0.13	<0.05	<0.008	<0.20	0.072	1.8	<0.8	0.12	----	----	----
February	0.03	<0.06	0.11	<0.05	<0.008	<0.13	0.053	<1.0	<0.8	0.11	----	----	----
March	0.04	<0.07	0.15	<0.08	<0.009	<0.10	0.069	<1.3	<0.8	0.12	----	----	----
April	<0.02	<0.06	0.20	<0.05	<0.007	<0.14	0.045	<1.0	<0.8	0.09	----	----	----
May	<0.01	<0.05	0.10	<0.05	<0.008	<0.20	0.056	<1.0	<0.8	<0.07	----	----	----
June	0.02	<0.05	0.14	<0.05	<0.008	<0.22	0.092	<1.0	<0.8	0.08	----	----	----
July	<0.02	<0.05	0.10	<0.05	<0.008	<0.37	0.101	<1.0	<0.8	0.08	----	----	----
August	0.02	<0.12	0.13	<0.08	<0.008	<0.27	0.079	<1.0	<0.8	0.08	----	----	----
September	0.03	<0.05	0.14	<0.05	<0.005	<0.28	0.078	<1.2	<0.8	0.10	----	----	----
October	0.02	<0.06	0.08	<0.05	0.002	<0.20	0.076	<1.0	---	0.11	3.2	0.24	0.24
November	0.03	<0.07	0.09	<0.05	0.002	<0.41	0.057	<1.0	---	0.11	3.2	0.19	0.10
December	0.02	<0.06	0.12	<0.05	0.001	<0.20	0.045	1.5	---	0.09	14.6	0.19	0.10
1982 Avg.	<0.02	<0.06	0.12	<0.06	<0.006	<0.23	0.069	<1.2	<0.8	<0.10	7.0	0.21	0.15

* Limits are median values.

1982 INFLUENT DATA
TREATMENT PLANT Metropolitan

MONTH	Cu mg/l	Cr mg/l	Zn mg/l	Pb mg/l	Cd mg/l	Hg ug/l	CN mg/l	As ug/l	Sn mg/l	Ni mg/l	Phenol ug/l	Fe mg/l	PCB ug/l
January													
February													
March													
April													
May													
June													
July													
August													
September													
October	0.20	0.22	0.32	<0.07	0.015	<0.52	<0.064	1.2	---	<0.12	58.4	2.43	0.37
November	0.21	0.24	0.34	<0.08	0.012	<0.59	0.108	<1.0	---	0.12	58.4	1.80	0.34
December	0.20	0.24	0.36	<0.07	0.015	<0.52	<0.073	1.7	---	<0.11	----	1.97	0.30
1982 Avg.	0.20	0.23	0.34	<0.07	0.014	<0.54	<0.082	<1.3	---	<0.12	58.4	2.07	0.34

ROSEMOUNT WASTEWATER TREATMENT PLANT

Plant History and Description

The Rosemount Plant was designed by Banister, Short, Elliot, Hendrickson, and Associates and constructed in 1973. The plant has a design capacity of 0.6 mgd.

Liquid treatment consists of physical-chemical processes, dual media filtration, activated carbon column absorption and chlorination. Plant effluent is discharged to the Spring Lake area of the Mississippi River.

Solids processing facilities consist of sludge storage and sludge hauling to the Metropolitan Plant Interceptor System. The plant is presently operating at about 50 percent of capacity and subject to secondary treatment limits, and a phosphorus limit of 1 mg/L.

Performance

Plant flow averaged 0.31 mgd in 1982, nearly equal to 0.30 mgd in 1981. Average plant effluent quality was 16 mg/L BOD, 2 mg/L TSS and 0.3 mg/L P. Plant performance was excellent throughout the year with one NPDES Permit violation (effluent pH) occurring in September. Statistical analysis of data show the following trend in effluent BOD and TSS from 1979 through 1982.

Effluent Concentration, mg/l

	50% of Time				75% of Time				90% of Time			
	1979	1980	1981	1982	1979	1980	1981	1982	1979	1980	1981	1982
BOD	10	11	12	15	15	14	15	18	20	20	19	24
TSS	2	2	1	1	3	3	2	2	5	3	3	4

Future

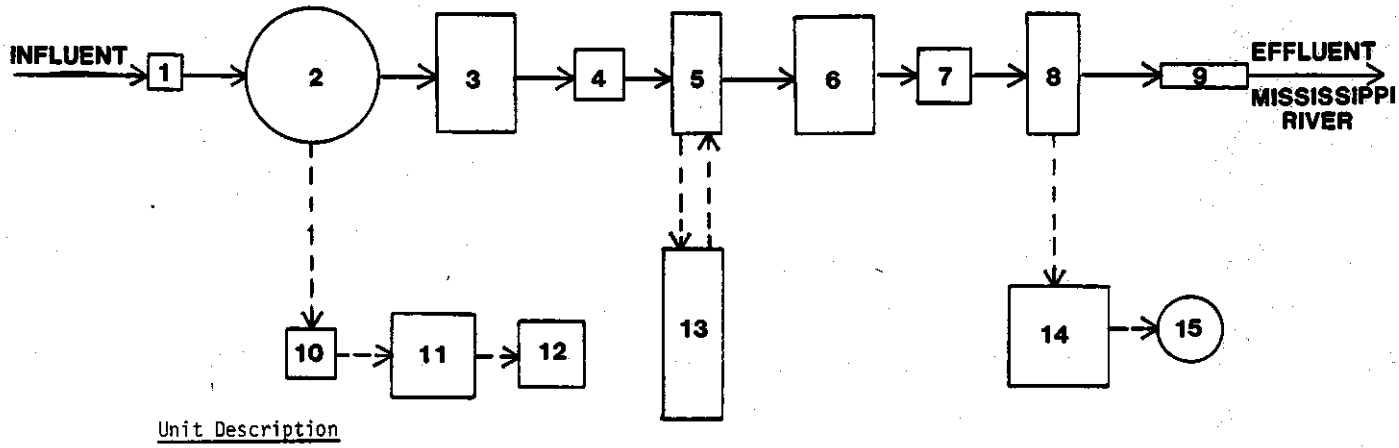
The plant was designed as a demonstration project and uses equipment intensive unit processes. As a result, the plant's useful life could be expected to be on the order of 10 to 15 years. For this reason, the plant is nearing the end of its useful life. The 201 Facility Plan recommended replacement of the physical-chemical facility with a biological treatment plant sometime during the 1980's. It is expected that a replacement plant will be constructed in the mid-1980's.

ROSEMOUNT PLANT PROCESS UNIT LOADINGS
1982

Parameter	Annual Average	Maximum Month
Wastewater Flow, MGD	0.31	0.40
BOD Loading, lb/day	440	490
TSS Loading, lb/day	620	700
Phosphorus Loading, lb/day	19	21
COD Loading, lb/day	1,100	1,200
Solids Contact Clarifier (One in Use)		
Surface Loading Rate, gpd/Sq. Ft.	700	900
TSS Removal, %	89	92
Phosphorus Removal, %	93	95
COD Removal, %	77	80
Dual Media Filters (Four in Use)		
Surface Loading Rate, gpm/Sq. Ft.	1.1	1.4
TSS Removal, %	59	80
Activated Carbon Columns (One Train)		
Surface Loading Rate, gpd/Sq. Ft.	4.3	5.6
COD Loading Rate, lb/day	190	290
COD Removal, %	28	60
TSS Removal, %	82	85
Sludge Production		
Volume, gpd	4,000	4,800
Quantity, lb/day	3,400	4,000
Concentration, % TS	10	12

ROSEMOUNT WASTEWATER TREATMENT PLANT

FLOW DIAGRAM



Unit Description

Liquid Phase

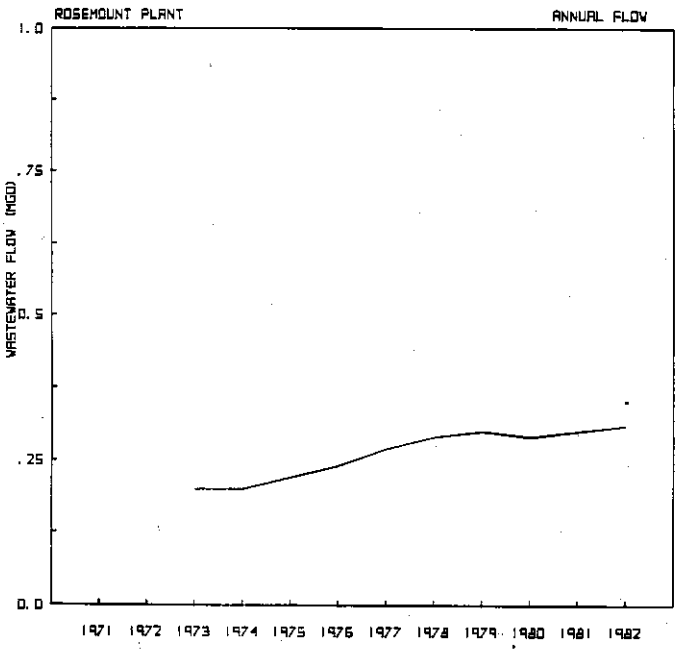
1. Screening
2. Solids Contact Clarifier
3. Dual Media Filters
4. Filtered Water Storage
5. Granular Carbon Columns
6. Dual Media Filters
7. Filtered Water Storage
8. Ion Exchange Columns
9. Chlorination

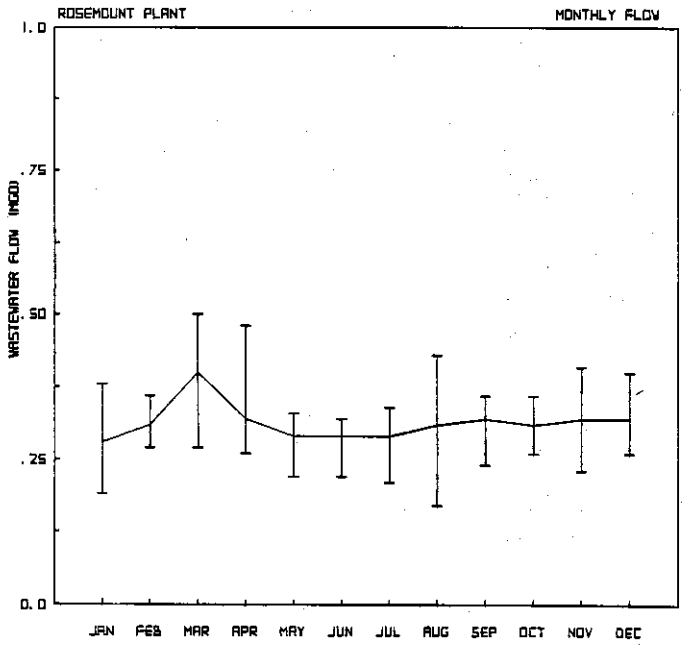
Solid Phase

10. Sludge Holding Tank
11. Sludge Dewatering
12. Land Spread
13. Carbon Regeneration System
14. Ion Exchange Regeneration System
15. Ammonia Recovery

Legend

- Liquid Flow
- Solids Transfer
- Existing Process Units
- Future Process Units



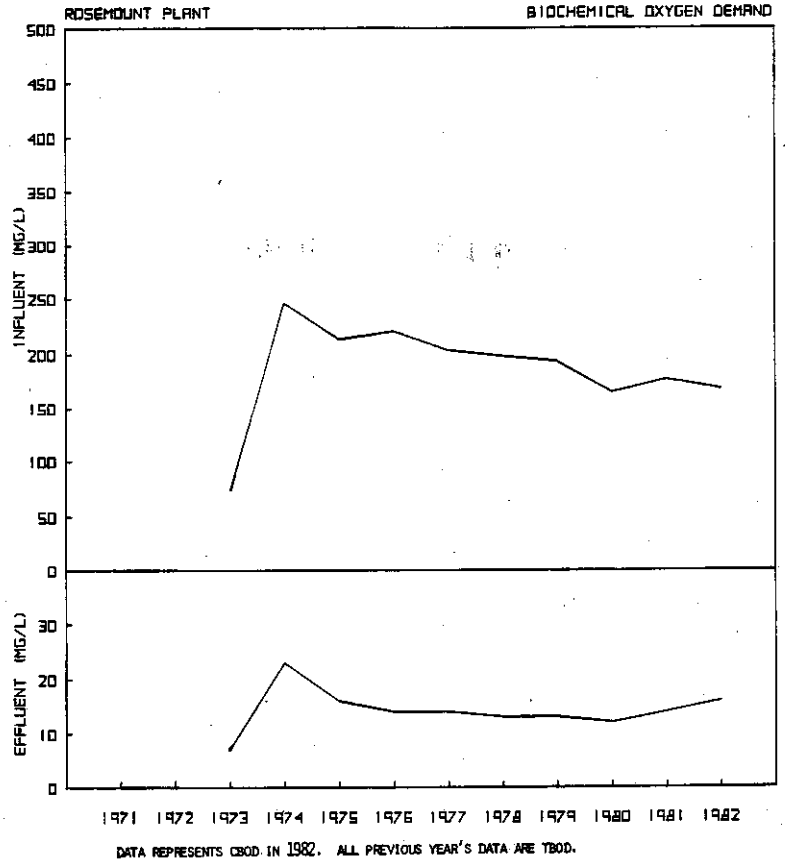


MONTHLY SUMMARY OF INFLUENT QUALITY
TREATMENT PLANT: Rosemount

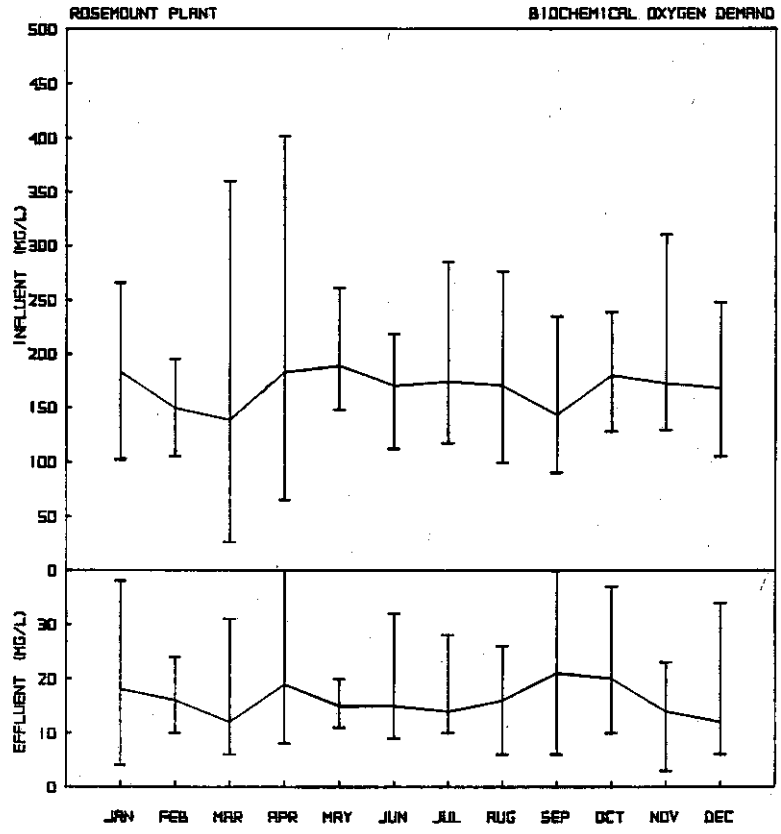
Month	Wastewater Flow, MGD	Temperature °C	TBOD mg/l	TSS mg/l	pH Range	KJN mg/l	Total-P mg/l	NH_3 mg/l	COD mg/l
JANUARY	0.28	12	183	215	7.0-8.7	60.5	8.6	29.1	399
FEBRUARY	0.31	11	149	230	6.8-8.1	55.0	7.0	26.5	410
MARCH	0.40	10	138	178	6.2-7.9	28.4	5.8	22.4	329
APRIL	0.32	10	183	243	6.6-7.9	81.4	7.8	28.6	403
MAY	0.29	12	189	250	6.8-7.7	49.0	8.5	26.9	428
JUNE	0.29	13	170	256	6.0-11.0	47.2	7.5	25.8	474
JULY	0.29	15	174	279	6.8-7.7	39.5	6.7	23.7	459
AUGUST	0.31	17	170	246	7.1-7.8	42.0	7.2	23.9	438
SEPTEMBER	0.32	17	143	230	7.2-7.9	46.0	7.0	28.1	396
OCTOBER	0.31	17	180	252	6.1-8.0	50.0	8.0	28.4	441
NOVEMBER	0.32	15	172	261	7.0-9.0	44.0	7.5	31.1	438
DECEMBER	0.32	13	168	227	6.8-8.0	44.5	7.3	30.2	435
1982 AVERAGE	0.31	14	168	239	6.0-11.0	49.0	7.4	27.1	421
1981 AVERAGE	0.30	14	177	221	6.8-8.5	----	---	----	423

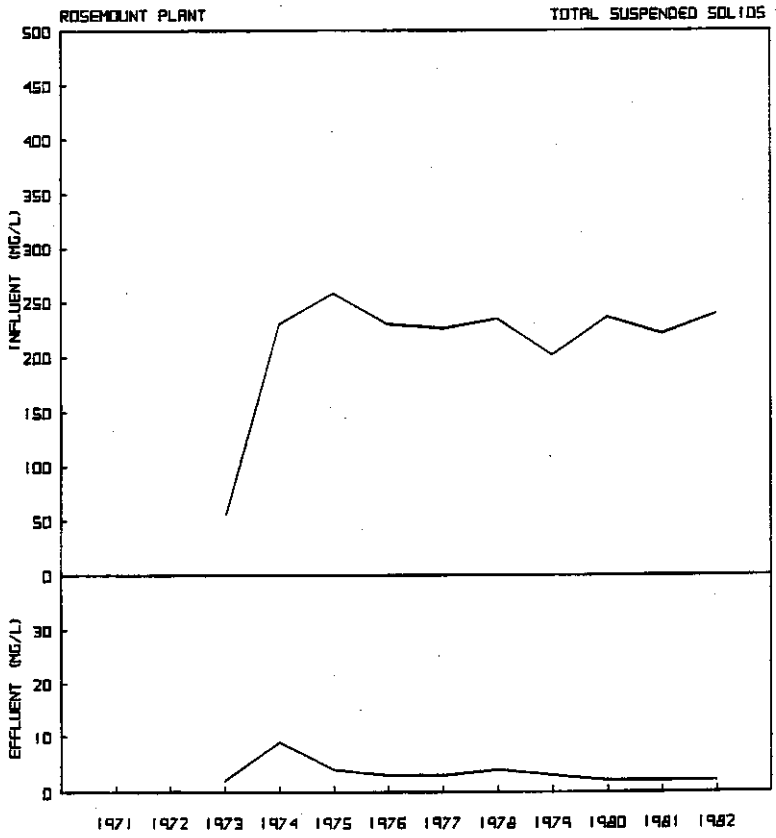
MONTHLY SUMMARY OF EFFLUENT QUALITY
TREATMENT PLANT: Rosemount

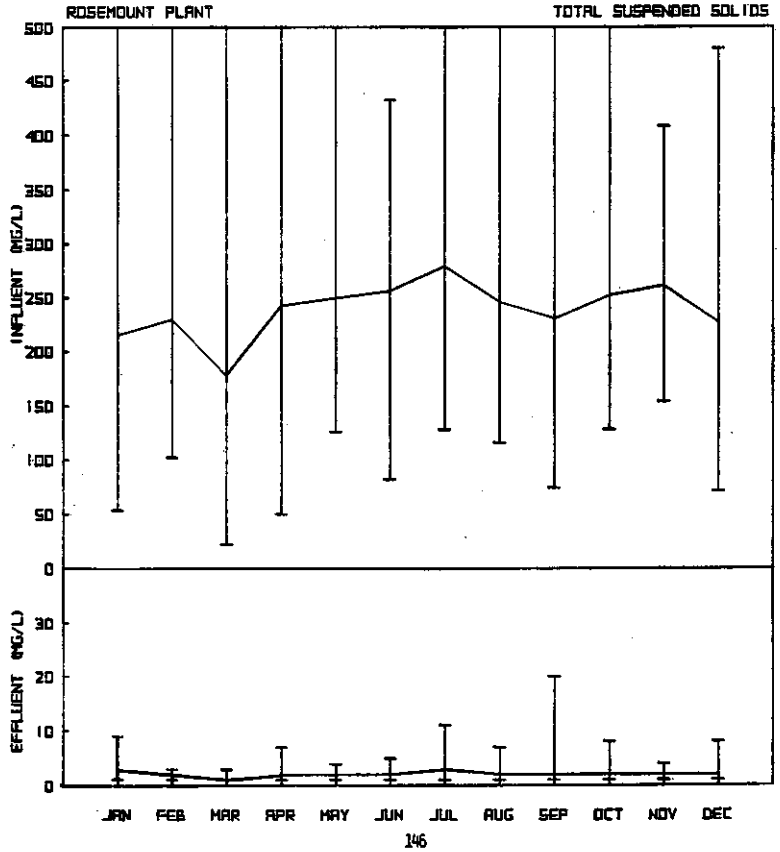
Month	TBOD mg/l	CBOD mg/l	COD mg/l	TSS mg/l	FECAL COLI Geo Mean no/100 ml	TURB NTU	KJN mg/l	NH_3 mg/l	NO_2 mg/l	NO_3 mg/l	Total P mg/l	Cl2 Used lbs	Cl2 Res mg/l	DO mg/l	pH Range	% Removal BOD	% Removal TSS
NPDES LIMIT	25	25	--	30	200	25	----	----	----	----	1.0	--	---	---	6.5-8.5	--	--
JANUARY	18	18	45	3	---	6	42.1	32.4	0.62	0.70	0.3	--	---	8.5	6.8-8.2	90	99
FEBRUARY	16	16	54	2	---	5	36.5	28.0	0.88	1.63	0.2	--	---	8.6	6.6-8.0	89	99
MARCH	12	12	31	1	1	3	26.9	22.1	0.17	1.63	0.2	31	2.2	8.7	6.5-7.4	91	99
APRIL	19	19	55	2	2	6	37.1	30.2	0.68	2.36	0.4	33	2.0	8.3	6.7-8.2	90	99
MAY	15	15	36	2	1	5	37.1	30.1	0.34	4.28	0.3	32	1.6	5.3	6.9-7.6	92	99
JUNE	20	15	48	2	1	7	35.5	26.8	0.30	1.02	0.4	43	1.3	4.8	6.7-7.6	91	99
JULY	17	14	40	3	2	4	32.4	24.7	0.44	1.70	0.2	42	1.4	4.9	6.8-7.5	92	99
AUGUST	19	16	41	2	5	4	33.6	25.0	0.81	3.15	0.2	38	1.4	5.1	6.9-7.6	90	99
SEPTEMBER	22	21	51	2	4	5	38.6	31.2	0.56	3.01	0.3	40	1.4	4.7	5.3-8.1	85	99
OCTOBER	24	20	46	2	4	5	36.0	30.4	0.03	0.16	0.3	50	1.6	4.9	6.6-7.9	89	99
NOVEMBER	15	14	39	2	---	4	36.2	32.9	1.10	2.20	0.2	--	---	4.8	6.6-8.0	92	99
DECEMBER	13	12	32	2	---	4	35.8	33.7	0.44	2.91	0.2	--	---	6.3	6.6-7.6	93	99
1982 AVG.	18	16	43	2	2	5	35.6	29.0	0.53	2.06	0.3	39	1.6	6.2	5.3-8.2	90	99
1981 AVG.	14	--	40	2	3	4	32.8	25.9	0.50	0.78	0.2	42	1.9	6.1	6.5-8.4	92	99

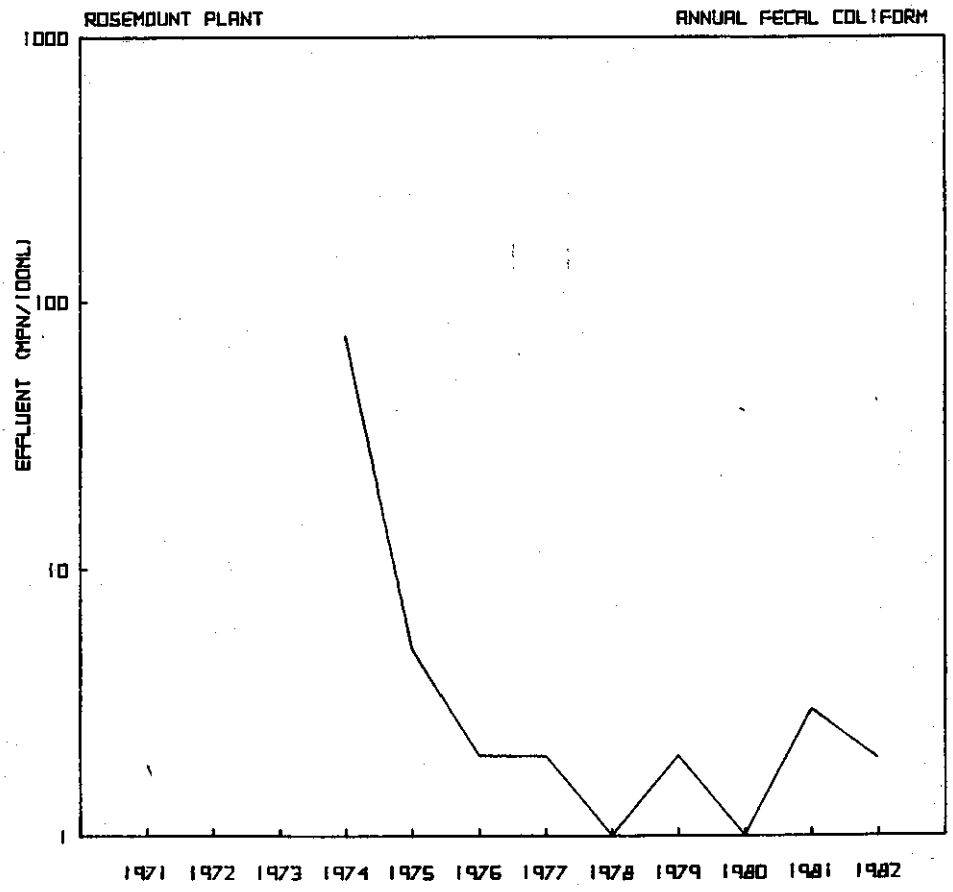


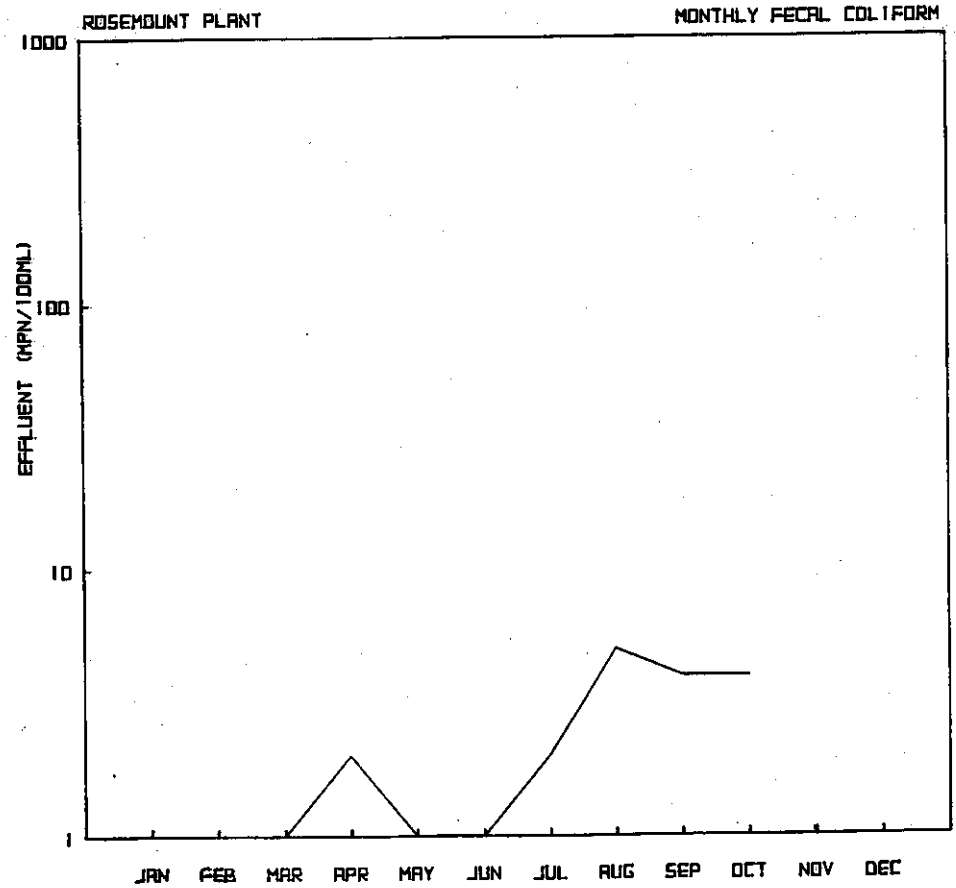
DATA REPRESENTS CBOD IN 1982. ALL PREVIOUS YEAR'S DATA ARE TBOD.

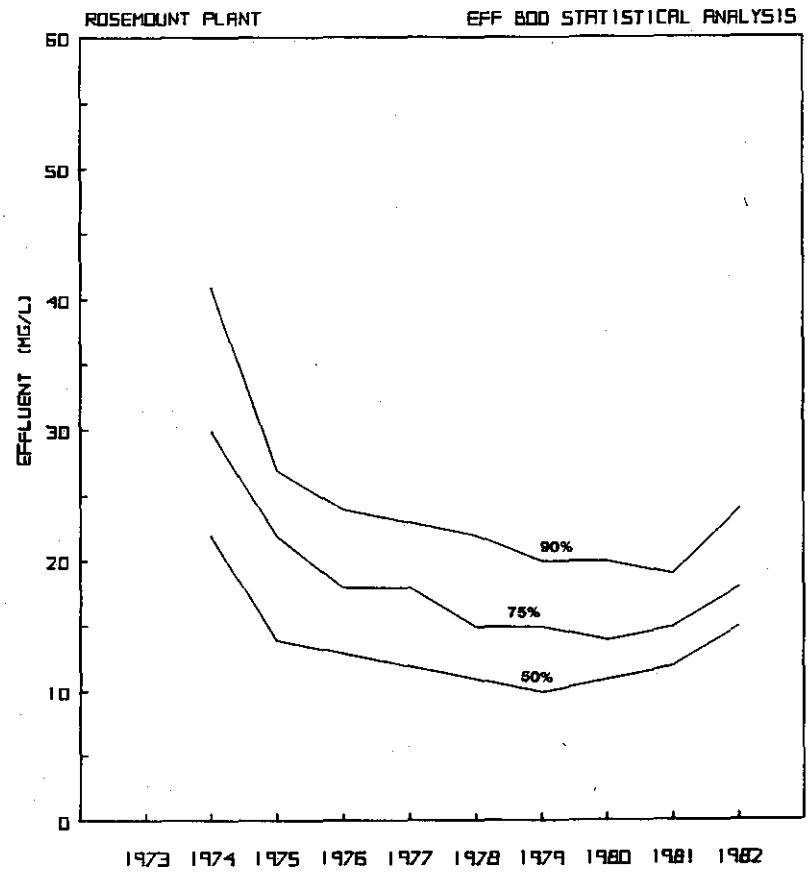


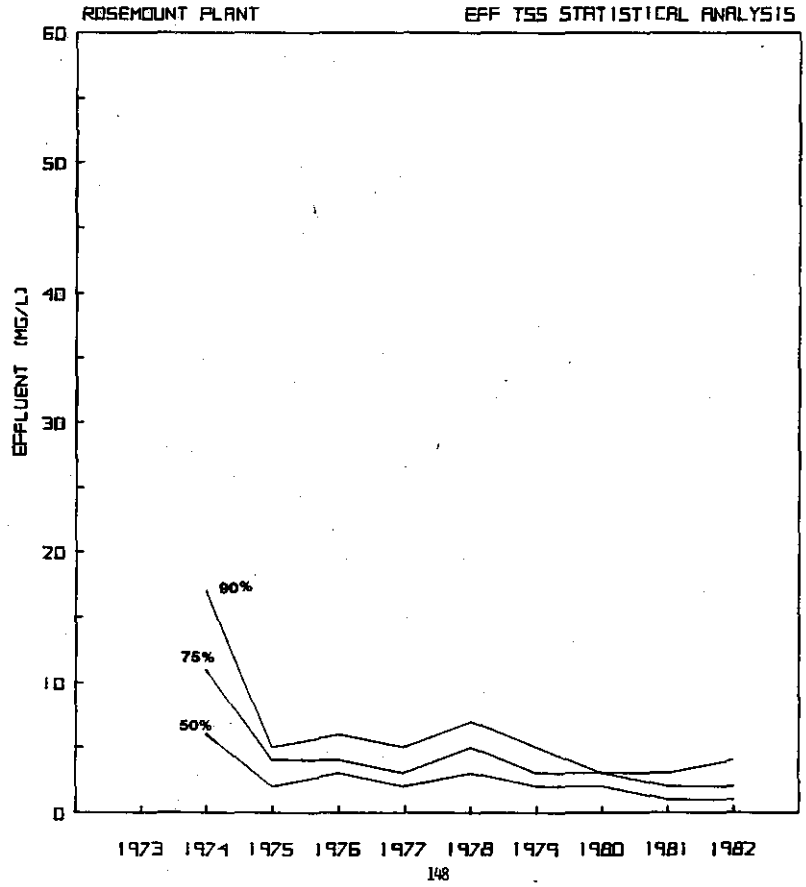

ROSEMOUNT PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
EFFLUENT (MG/L)
30
20
10
0
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982


ROSEMOUNT PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
EFFLUENT (MG/L)
30
20
10
0
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


ROSEMOUNT PLANT
ANNUAL FECAL COLIFORM
EFFLUENT (MPN/100ML)
1000
100
10
1
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982


ROSEMOUNT PLANT
MONTHLY FECAL COLIFORM
EFFLUENT (MPN/100ML)
1000
100
10
1
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC


ROSEMOUNT PLANT
EFF BOD STATISTICAL ANALYSIS
EFFLUENT (MG/L)
60
50
40
30
20
10
0
90%
75%
50%
1973 1974 1975 1976 1977 1978 1979 1980 1981 1982


ROSEMOUNT PLANT
EFF TSS STATISTICAL ANALYSIS
EFFLUENT (MG/L)
60
50
40
30
20
10
0
90%
75%
50%
1973 1974 1975 1976 1977 1978 1979 1980 1981 1982

SAVAGE WASTEWATER TREATMENT PLANT

Plant History and Description

The original Savage Treatment Plant was designed by Ellison-Philstrom, Inc. and constructed in 1963 with a capacity of 0.36 mgd. Interim improvements to the plant were designed by RCM and construction was completed in 1979. These plant modifications included the addition of a new synthetic media trickling filter, a new chlorine contact tank and a new sludge holding/decant tank. The current plant design capacity is 0.72 mgd. The plant serves the community of Savage in Service Area No. 4.

Liquid treatment consists of screening, influent pumping, primary clarification , a roughing filter, a synthetic media high-rate trickling filter, final clarification, chlorination and discharge to the Minnesota River.

Solids processing consists of a sludge holding and decant tank, anaerobic digestion, and sludge hauling to another plant for further treatment or sludge landspreading. The plant is presently operating at about 67 percent of its design capacity and is subject to secondary treatment limits.

Performance

Plant flow averaged 0.48 mgd during 1982, slightly higher than 0.40 mgd in 1981. Average plant effluent quality was 8 mg/L BOD and 4 mg/L TSS. Plant performance was good throughout the year with one NPDES Permit violation. The permit violation consisted of exceeding weekly BOD limits during the month of November and was the result of an industrial discharge. Statistical analysis of data show the following trend in effluent BOD and TSS from 1979 through 1982.

Effluent Concentration, mg/l

	50% of Time				75% of Time				90% of Time			
	1979	1980	1981	1982	1979	1980	1981	1982	1979	1980	1981	1982
BOD	26	5	9	6	41	7	12	9	59	9	15	20
TSS	10	4	5	2	18	7	12	5	28	15	17	11

Future

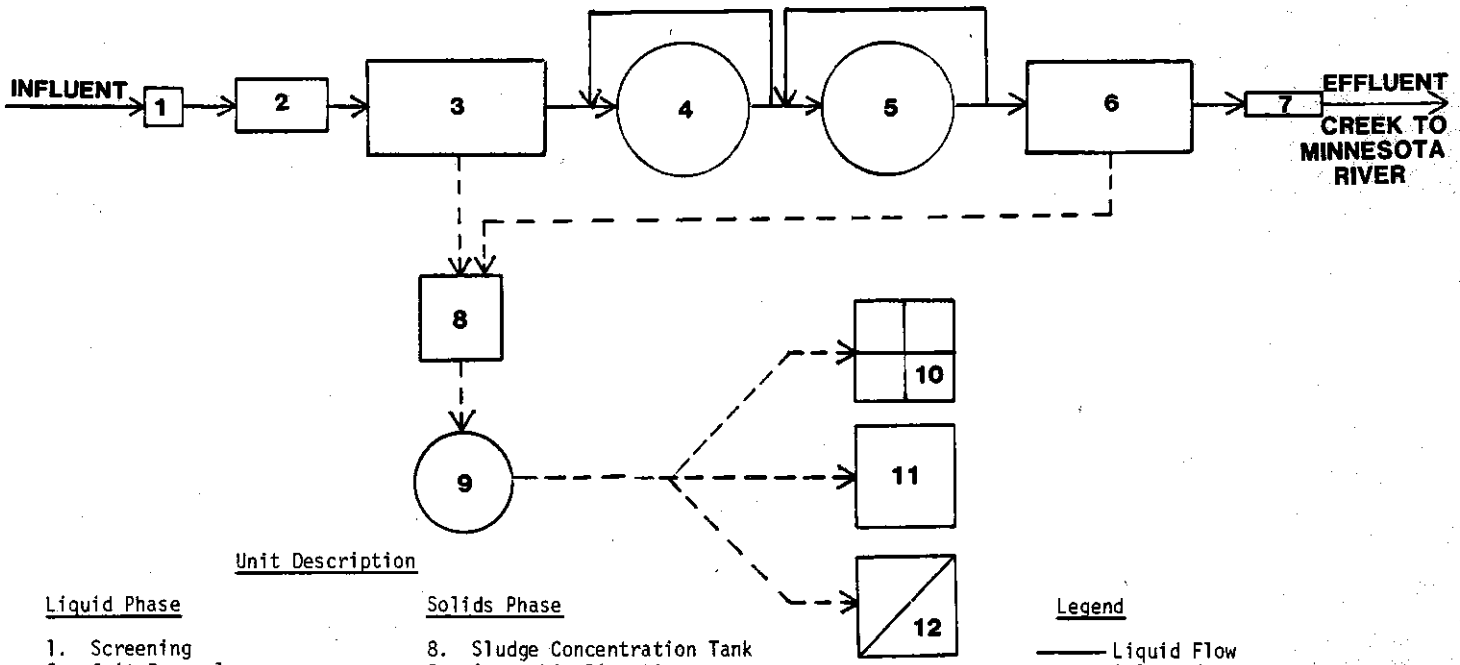
The long-term plan for the Savage Plant is to phase it out of service and divert the flow to the Seneca Plant. This is projected to occur in the late 1980's as the plant reaches its capacity.

SAVAGE PLANT PROCESS UNIT LOADINGS
1982

Parameter	Annual Average	Maximum Month
Wastewater Flow, MGD	0.48	0.62
BOD Loading, lb/day	610	910
TSS Loading, lb/day	700	1,010
COD Loading, lb/day	1,120	1,400
Sludge Production, lb/day	280	---
Grit Removal		
Overflow Rate, gpd/Sq. Ft.	26,700	34,400
Primary Sedimentation		
Detention Time, Hr.	1.5	1.2
Weir Overflow Rate, gpd/Lin. Ft.	6,960	8,990
Surface Overflow, gpd/Sq. Ft.	1,260	1,630
Trickling Filter No. 1		
Hydraulic Loading, gpd/Sq. Ft. (Inc. Recir.)	±400	---
Organic Loading, lb. BOD_5/Day/1000 Cu. Ft. (Assume 20% Primary BOD Removal)	±45	---
Trickling Filter No. 2		
Hydraulic Loading, gpd/Sq. Ft. (Inc. Recir.)	±3,000	-----
Organic Loading, lb. BOD_5/Day/1000 Cu. Ft. (Assume 50% Filter No. 1 BOD Removal)	±10	-----
Final Sedimentation		
Detention Time, Hr.	2.4	1.8
Weir Overflow Rate, gpd/Lin. Ft.	5,000	6,460
Surface Overflow Rate, gpd/Sq. Ft.	530	680
Chlorination		
Contact Time, Minutes	73	56
Chlorine Use, lb/day	19	30
Sludge Holding Tank		
Detention Time, Days	±11	---
Anaerobic Digester		
Detention Time, Days	±50	---
Solids Loading, lb/Cu. Ft./Day	±0.05	---
Sludge Transport		
Volume, Gal./Day	690	---

SAVAGE WASTEWATER TREATMENT PLANT

FLOW DIAGRAM



Unit Description

Liquid Phase

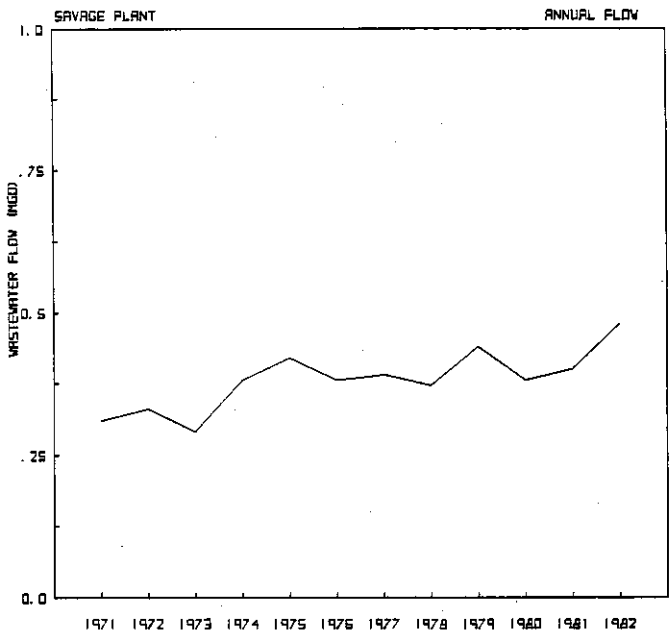
1. Screening
2. Grit Removal
3. Primary Sedimentation
4. Roughing Trickling Filter
5. Trickling Filter
6. Final Clarification
7. Chlorination

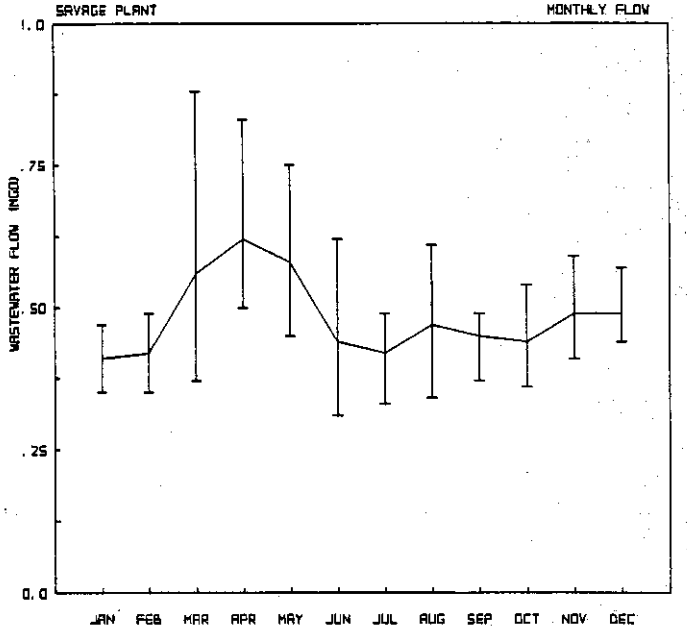
Solids Phase

8. Sludge Concentration Tank
9. Anaerobic Digestion
10. Drying Beds
11. Landspreading
12. Solids Disposal at Seneca Plant

Legend

- Liquid Flow
- Solids Transfer
- Existing Process Units
- Future Process Units



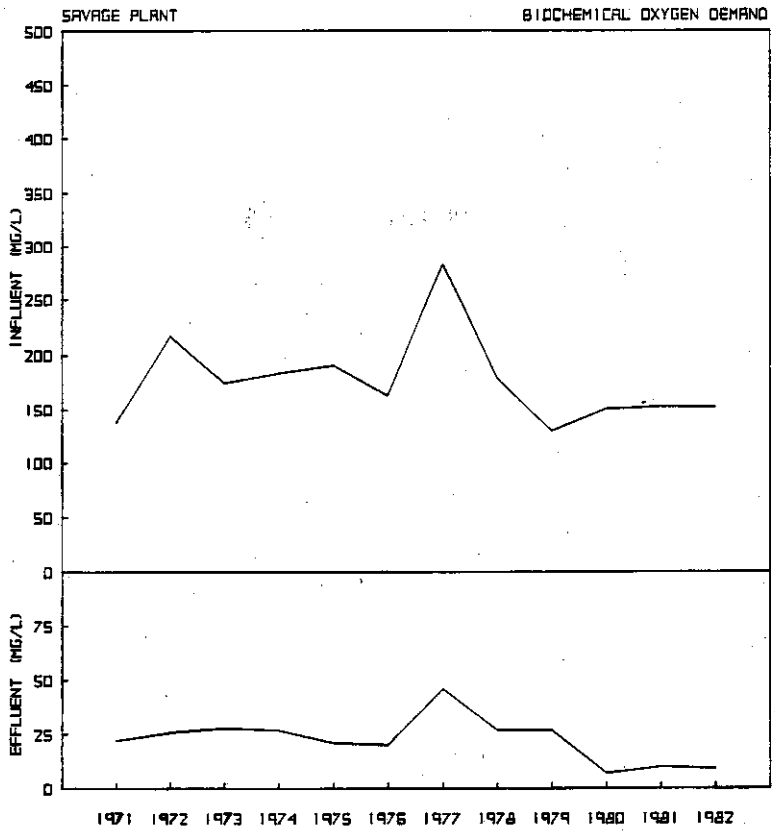


MONTHLY SUMMARY OF INFLUENT QUALITY
TREATMENT PLANT: Savage

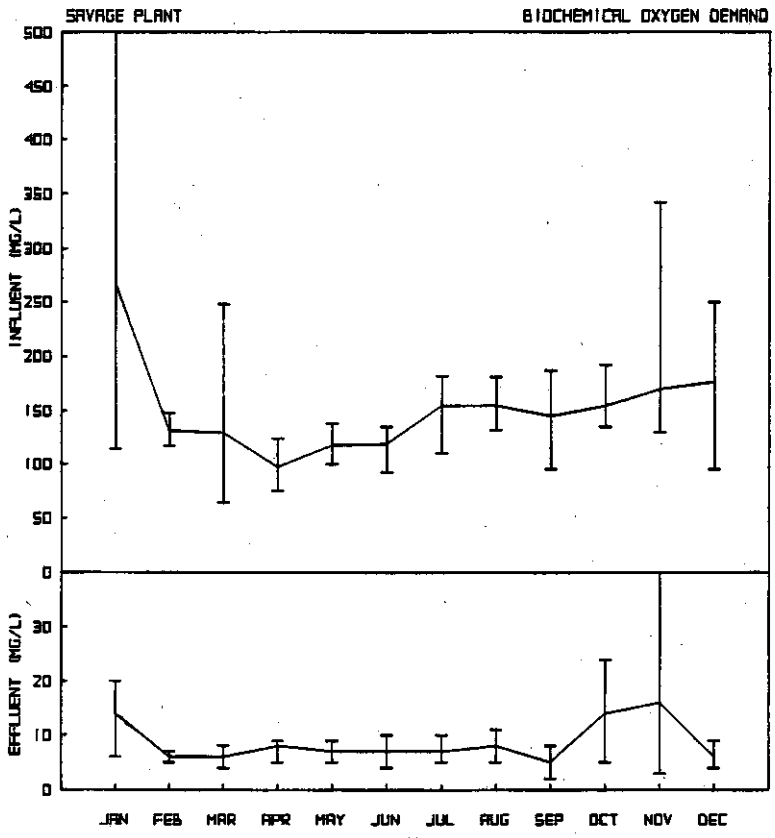
Month	Wastewater Flow, MGD	Temperature °C	TBOD mg/l	TSS mg/l	pH Range	KJN mg/l	Total-P mg/l	NH_3 mg/l	COD mg/l
JANUARY	0.41	10	267	210	2.0-11.6	27.4	5.0	17.1	409
FEBRUARY	0.42	9	131	179	2.0-12.4	31.1	8.4	17.7	274
MARCH	0.56	8	129	126	6.4-10.6	19.2	7.4	12.2	200
APRIL	0.62	8	97	107	6.4-9.4	20.6	4.3	12.3	207
MAY	0.58	12	118	120	6.4-9.8	21.5	5.9	11.4	216
JUNE	0.44	14	119	160	6.4-9.6	27.0	7.4	14.1	315
JULY	0.42	16	155	179	6.0-12.0	27.8	5.5	15.0	272
AUGUST	0.47	17	155	179	5.2-12.8	30.7	11.6	16.6	291
SEPTEMBER	0.45	17	145	225	6.0-13.4	33.2	5.5	18.4	358
OCTOBER	0.44	15	155	197	0.2-13.6	30.5	6.2	14.4	305
NOVEMBER	0.49	13	170	182	4.2-12.8	27.5	4.9	15.6	259
DECEMBER	0.49	11	177	175	2.0-10.0	27.1	4.8	16.9	264
1982 AVERAGE	0.48	13	151	170	0.2-13.6	27.0	6.4	15.1	281
1981 AVERAGE	0.40	15	153	234	4.0-12.2	----	----	----	336

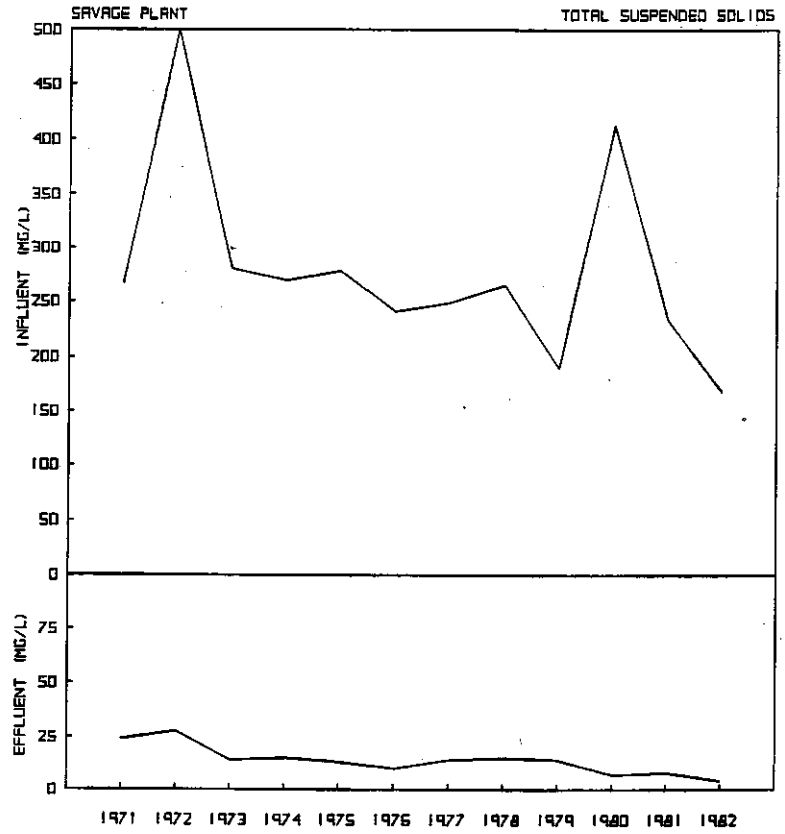
MONTHLY SUMMARY OF EFFLUENT QUALITY
TREATMENT PLANT: Savage

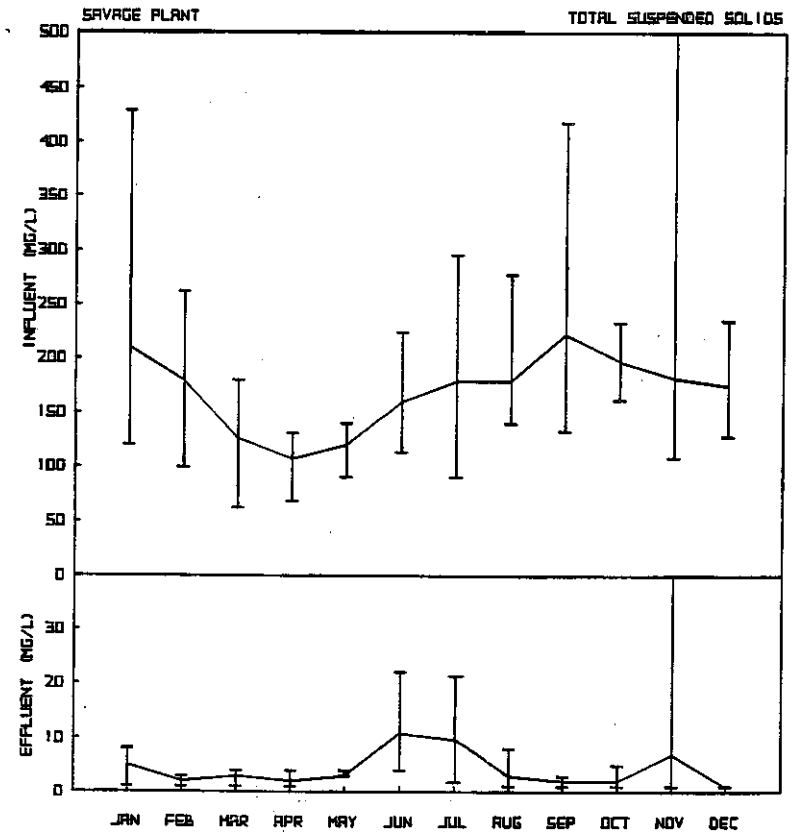
Month	TBOD mg/l	CBOD mg/l	COD mg/l	TSS mg/l	FECAL COLI Geo Mean no/100 ml	TURB NTU	KJN mg/l	NH_3 mg/l	NO_2 mg/l	NO_3 mg/l	Total P mg/l	Cl2 Used lbs	Cl2 Res mg/l	DO mg/l	pH Range	% Removal BOD	% Removal TSS
NPDES LIMIT	25	25	--	30	200	25	----	---	----	-----	---	--	---	----	6.5-8.5	--	--
JANUARY	14	14	44	5	---	4	4.4	2.2	0.53	7.10	3.3	--	---	9.7	7.4-7.9	95	98
FEBRUARY	7	6	47	2	---	3	4.6	1.0	0.19	10.70	3.9	--	---	10.1	7.4-7.9	96	99
MARCH	6	6	46	3	5	4	2.8	1.4	0.11	7.06	4.7	28	2.2	10.0	7.4-7.8	96	98
APRIL	7	8	39	2	3	4	3.0	1.3	0.10	6.60	3.3	30	2.0	10.1	7.4-7.7	92	98
MAY	6	7	33	3	19	3	3.0	0.5	0.09	6.13	4.3	21	1.9	9.0	7.4-7.8	94	97
JUNE	11	7	75	11	10	10	3.5	0.9	0.07	9.54	4.5	17	2.0	8.2	7.4-7.8	94	93
JULY	8	7	41	10	57	8	2.1	0.2	0.02	11.33	3.9	14	1.9	8.0	7.4-7.8	96	94
AUGUST	9	8	37	3	35	3	2.2	0.3	0.03	14.47	4.9	12	1.9	8.1	7.4-7.8	95	99
SEPTEMBER	6	5	31	2	129	4	3.1	0.2	0.02	9.74	3.5	15	1.9	8.0	7.4-7.8	97	99
OCTOBER	15	14	57	2	11	4	11.3	5.1	0.13	7.14	3.4	16	1.9	8.6	7.4-7.8	91	99
NOVEMBER	17	16	58	7	---	4	8.4	4.0	0.70	6.20	3.5	--	--	9.2	7.4-7.9	90	96
DECEMBER	7	6	24	1	---	3	1.7	0.4	0.29	8.09	3.0	--	--	9.1	7.4-7.8	97	99
1982 AVG.	9	8	44	4	34	5	4.1	1.5	0.19	8.67	3.8	19	2.0	9.0	7.4-7.9	94	97
1981 AVG.	10	--	48	8	39	5	4.2	0.4	0.09	12.27	4.0	19	1.8	8.8	7.2-8.2	93	97

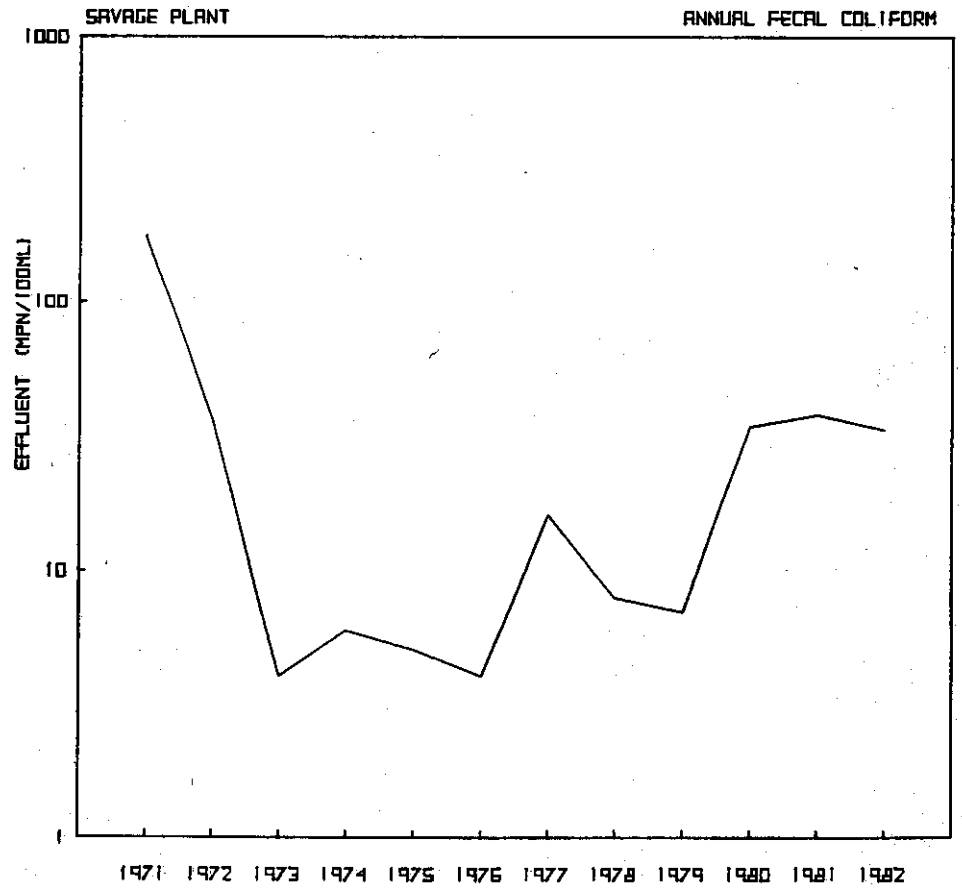


DATA REPRESENTS CBOD IN 1982. ALL PREVIOUS YEAR'S DATA ARE TBOD.




SAVAGE PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
EFFLUENT (MG/L)
75
50
25
0
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982


SAVAGE PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
EFFLUENT (MG/L)
30
20
10
0
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC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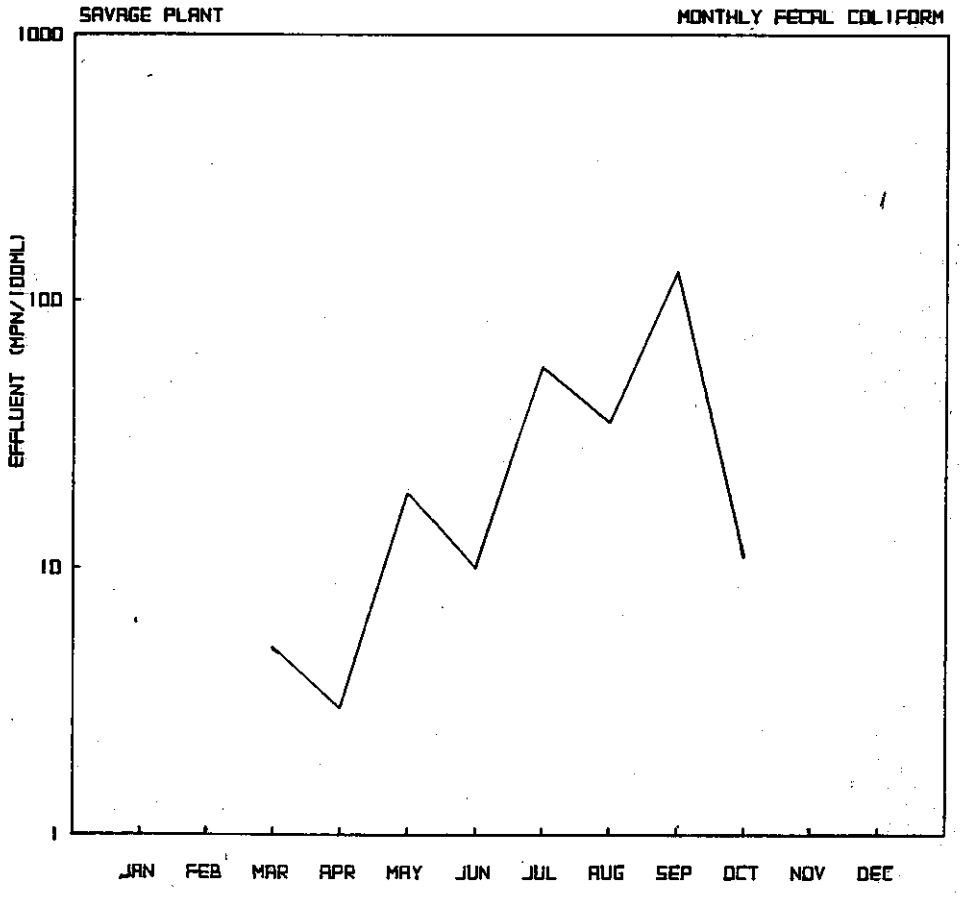
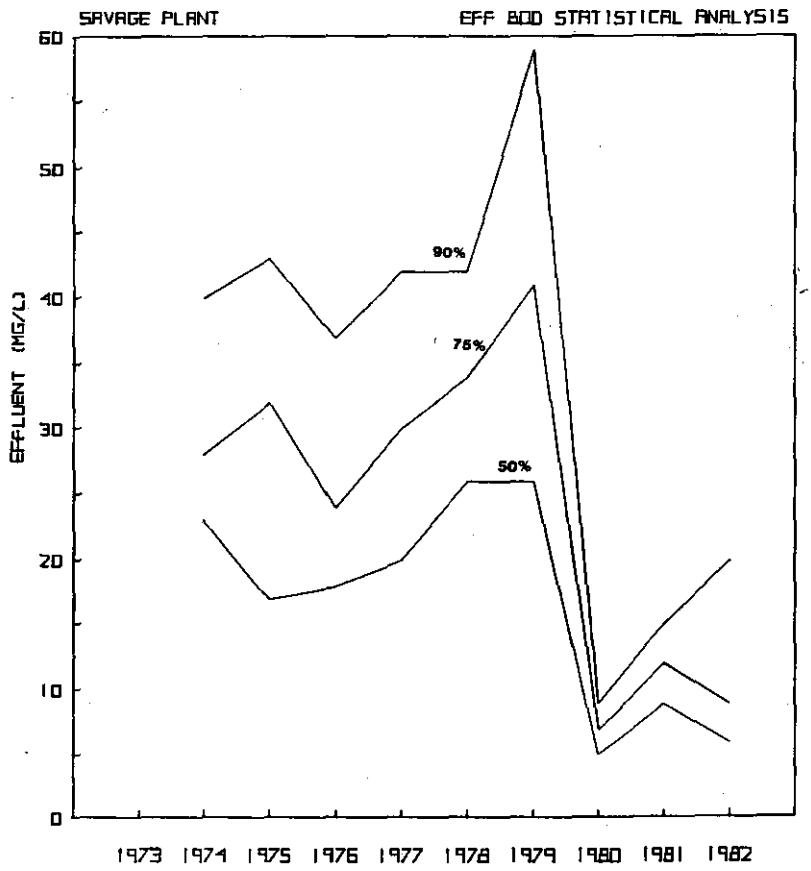
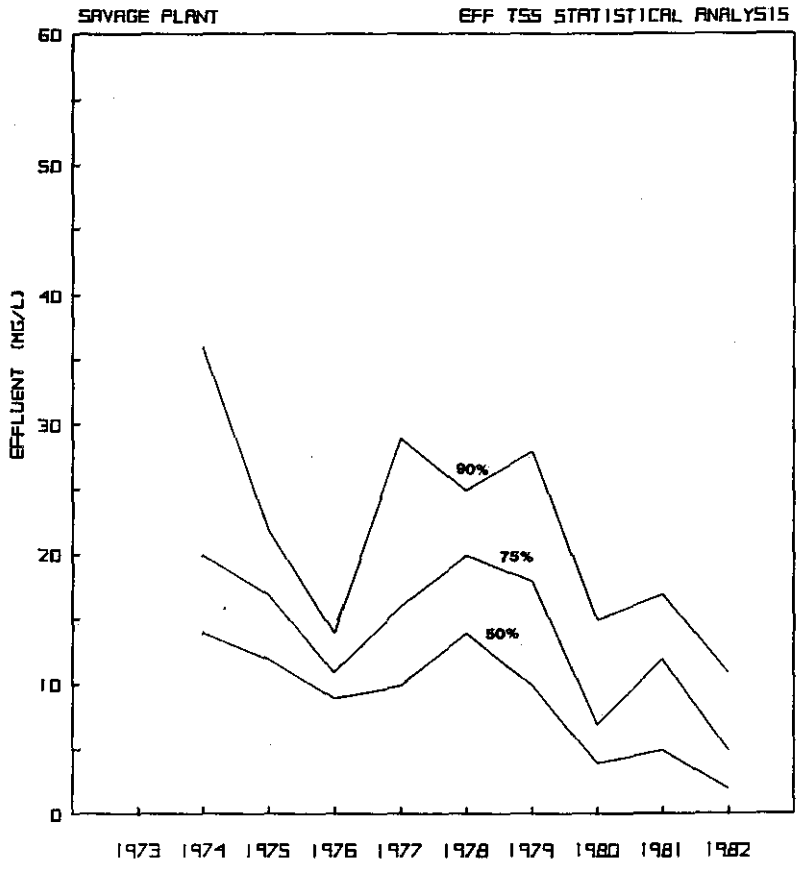
ANNUAL FECAL COLIFORM
1000
100
10
1
EFFLUENT (MPN/100ML)
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982


SAVAGE PLANT
MONTHLY FECAL COLIFORM
1000
100
10
1
EFFLUENT (MPN/100ML)
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


SAVAGE PLANT
EFF BOD STATISTICAL ANALYSIS
EFFLUENT (MG/L)
60
50
40
30
20
10
0
90%
75%
50%
1973 1974 1975 1976 1977 1978 1979 1980 1981 1982


SAVAGE PLANT
EFF TSS STATISTICAL ANALYSIS
EFFLUENT (MG/L)
60
50
40
30
20
10
0
90%
75%
50%
1973 1974 1975 1976 1977 1978 1979 1980 1981 1982

SENECA WASTEWATER TREATMENT PLANT

Plant History and Description

The Seneca Plant was designed by Black and Veastch Consulting Engineers, and was placed into operation in 1972, with a design capacity of 24 mgd.

Liquid treatment consists of screening, grit removal, primary sedimentation, complete mix activated sludge aeration, final clarification, chlorination, and discharge to the Minnesota River.

Solids processing consists of waste activated sludge air floatation thickening, combined sludge storage, chemical conditioning, vacuum filtration dewatering, and incineration. A polymer conditioning system and belt filter press dewatering system has been added during 1982-1983 and will become operational in mid-1983. The plant is presently operating at about 65 percent of its design capacity and is subject to secondary treatment limits.

Performance

Plant flow averaged 14.7 mgd during 1982, considerably higher than 13.8 mgd in 1981. Average plant effluent quality was 18 mg/L BOD and 19 mg/L TSS. Plant performance was good throughout the year with one NPDES Permit violation of effluent pH range. Statistical analysis of data show the following trend in effluent BOD and TSS from 1979 through 1982.

Effluent Concentration, mg/l

	50% of Time				75% of Time				90% of Time			
	1979	1980	1981	1982	1979	1980	1981	1982	1979	1980	1981	1982
BOD	14	14	19	17	18	20	22	21	27	25	30	25
TSS	13	15	19	19	24	19	23	23	32	23	28	26

Future

The Seneca Plant is one of the Commission's permanent regional plants. Space is available for future plant expansion and advanced treatment as needed. Additional sludge dewatering facilities have been added and other sludge processing improvements are planned.

SENECA PLANT PROCESS UNIT LOADINGS
1982

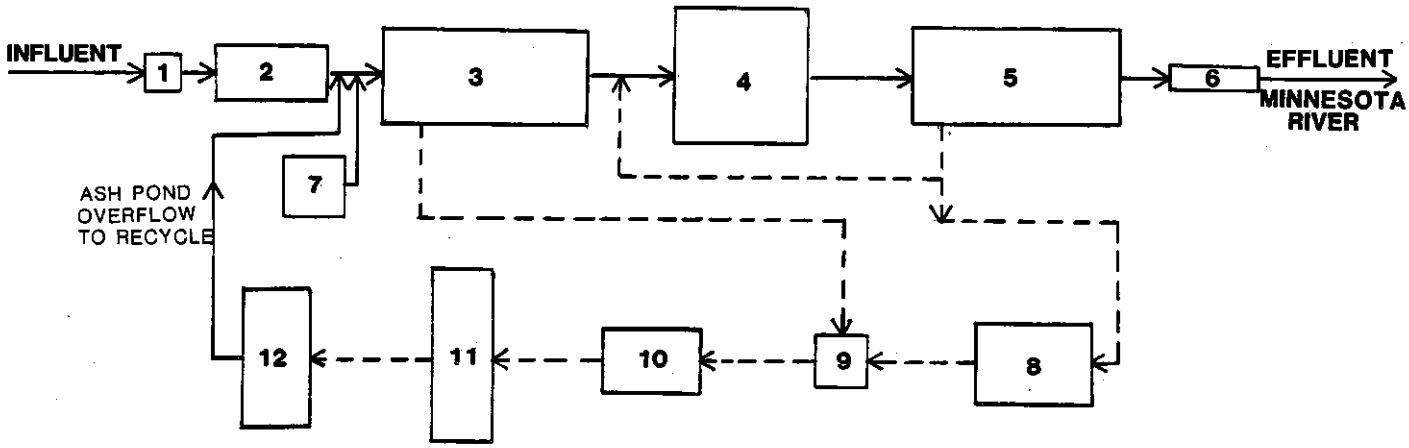
Parameter	Annual Average	Maximum Month
Wastewater Flow, MGD	14.8	15.9
BOD Loading, lb/day	27,200	32,500
TSS Loading, lb/day	25,000	34,600
Grit Chambers		
Detention Time, Minutes	25	23
Primary Clarifiers		
Surface Overflow Rate, gpd/Sq. Ft.	320	340
Weir Overflow Rate, gpd/Lin. Ft.	6,700	7,200
Detention Time, Hr.	6.8	6.3
Removal Efficiency, % BOD	28	39
Removal Efficiency, % TSS	72	74
Aeration Tanks (Two)		
BOD Loading, lb/Day/1000 Cu. Ft.	92	102
F:M Ratio, lb/Day/lb. MLSS	0.58	0.69
Detention Time, Hr.	2.4	2.2
Final Clarifiers (Two)		
Surface Overflow Rate, gpd/Sq. Ft.	600	650
Weir Overflow Rate, gpd/Lin. Ft.	9,900	10,600
Detention Time, Hr.	4.5	4.2
Chlorination		
Chlorine Dose, mg/L	4.3	5.0
Chlorine Feed Rate, lb/Day	520	610
Contact Time, Minutes	36	34
Flotation Thickeners		
Solids Loading, psf/Day	12	15
Vacuum Filters*		
Lime Dose, %	30	40
Ferric Chloride Dose, %	8	10
Filtration Rate, psf/Hr.	3.2	3.5
Cake Solids, %	23.5	24.7

Parameter	Annual Average	Maximum Month
Incinerators*		
Wet Sludge Loading Rate, psf/Hr.	4.0	4.3
Dry Solids Loading, lb/Hr.	1,700	1,800
Auxiliary Fuel Use, MMBtu/TDS	10	14

*Solids processed includes sludge from Blue Lake Plant.

SENECA WASTEWATER TREATMENT PLANT

FLOW DIAGRAM



Unit Description

Liquid Phase

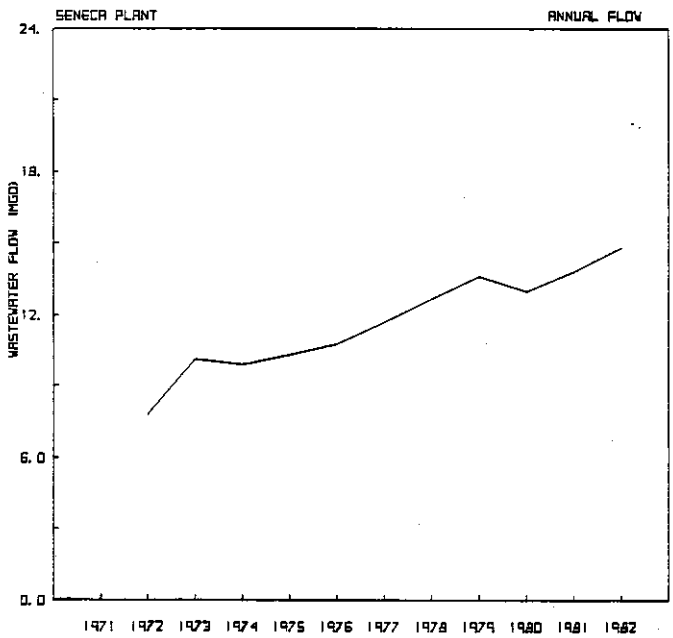
1. Screening
2. Grit Removal
3. Primary Sedimentation
4. Activated Sludge
5. Final Sedimentation
6. Chlorination
7. Chemical Addition and/or Pre-Chlorination

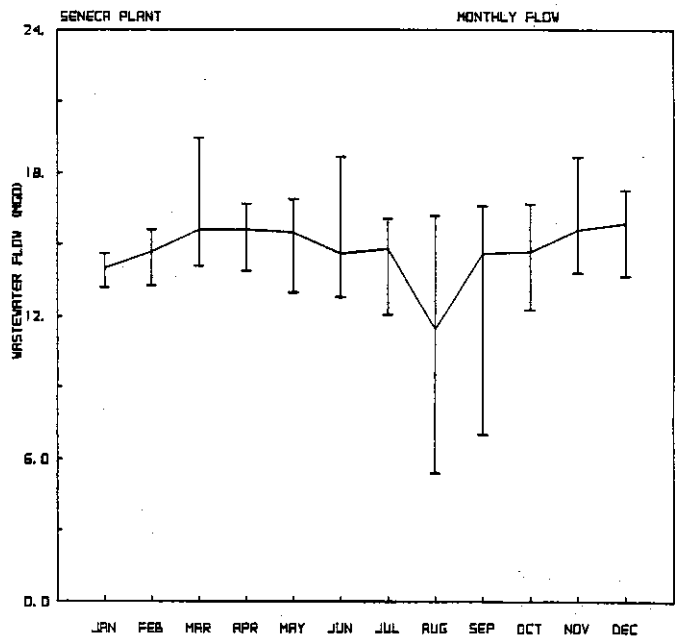
Solid Phase

8. Flotation Thickener
9. Holding Tank
10. Vacuum Filtration
11. Incineration
12. Ash Pond

Legend

- Liquid Flow
- Solids Transfer
- Existing Process Units
- Future Process Units



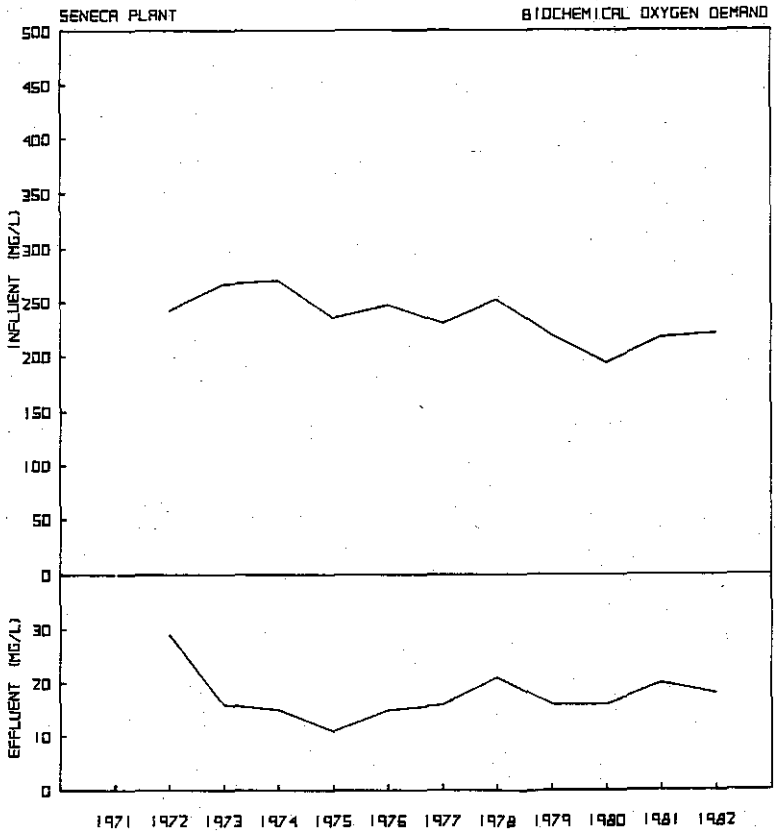


MONTHLY SUMMARY OF INFLUENT QUALITY
TREATMENT PLANT: Seneca

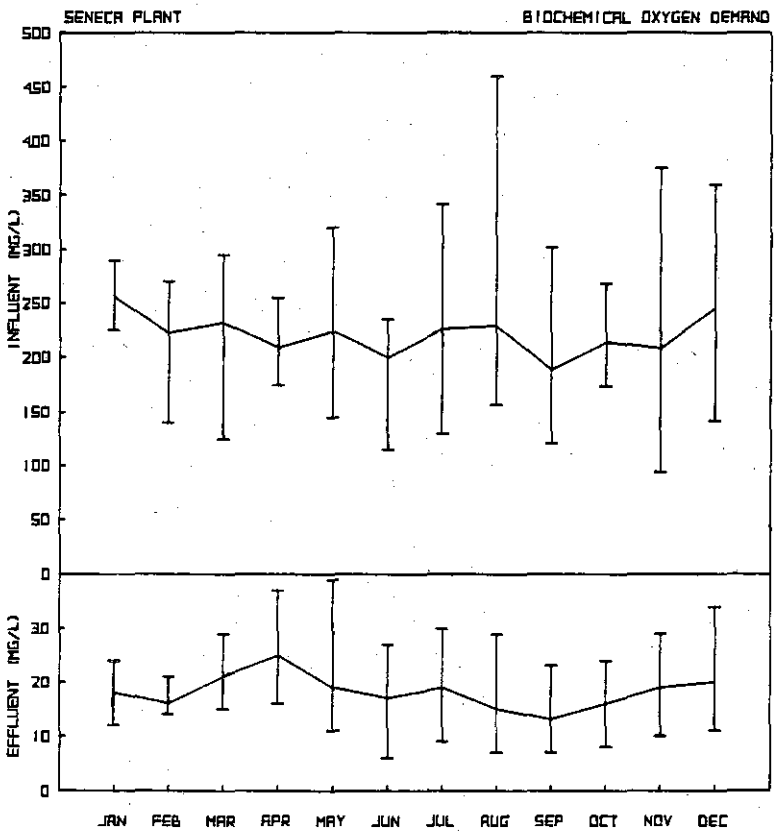
Month	Wastewater Flow, MGD	Temperature °C	TBOD mg/l	TSS mg/l	pH Range	KJN mg/l	Total-P mg/l	NH_3 mg/l	COD mg/l
JANUARY	14.0	14	256	255	6.7-8.2	42.8	9.8	24.3	562
FEBRUARY	14.7	13	222	255	6.6-7.6	53.0	9.0	23.7	540
MARCH	15.6	13	232	266	6.4-8.2	33.6	7.2	23.0	511
APRIL	15.6	13	209	186	6.7-7.7	33.9	7.3	21.8	419
MAY	15.5	16	224	208	6.7-7.4	51.7	8.6	21.8	435
JUNE	14.6	18	200	210	6.3-7.5	36.5	8.2	20.3	433
JULY	14.8	20	226	180	6.3-7.3	36.2	7.3	18.3	435
AUGUST	11.5	20	229	207	6.5-8.1	34.3	7.0	16.0	436
SEPTEMBER	14.6	19	189	158	6.5-8.3	32.7	5.9	18.3	348
OCTOBER	14.7	19	214	167	6.6-7.3	38.1	8.3	18.6	432
NOVEMBER	15.6	17	208	158	6.6-7.8	40.5	7.4	25.7	420
DECEMBER	15.9	15	245	186	6.6-8.5	39.6	7.6	23.8	501
1982 AVERAGE	14.7	16	221	203	6.3-8.5	39.4	7.8	21.3	456
1981 AVERAGE	13.8	17	217	211	6.5-10.4	----	---	----	488

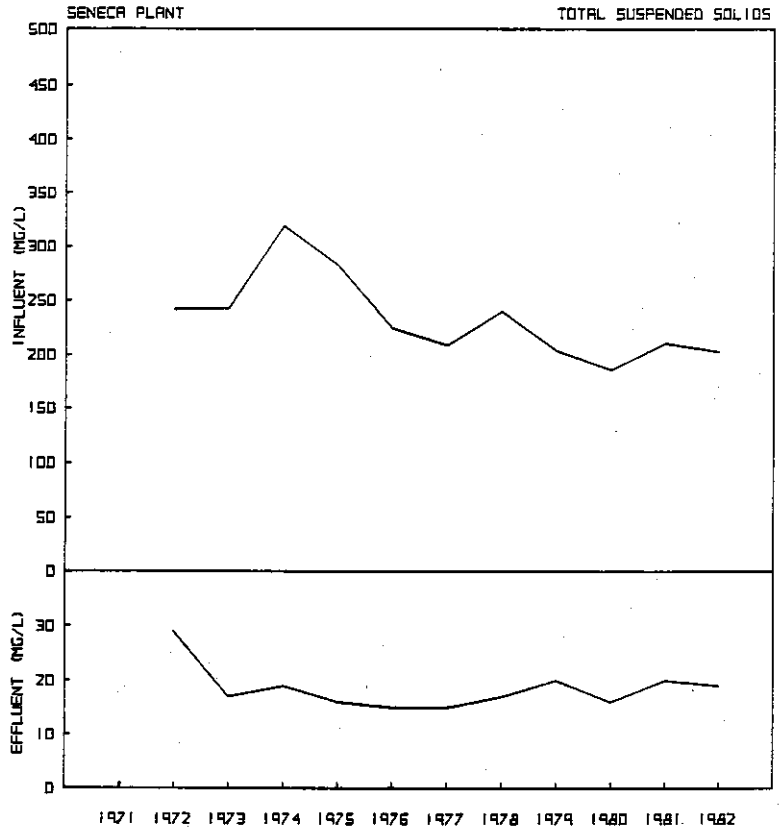
MONTHLY SUMMARY OF EFFLUENT QUALITY
TREATMENT PLANT: Seneca

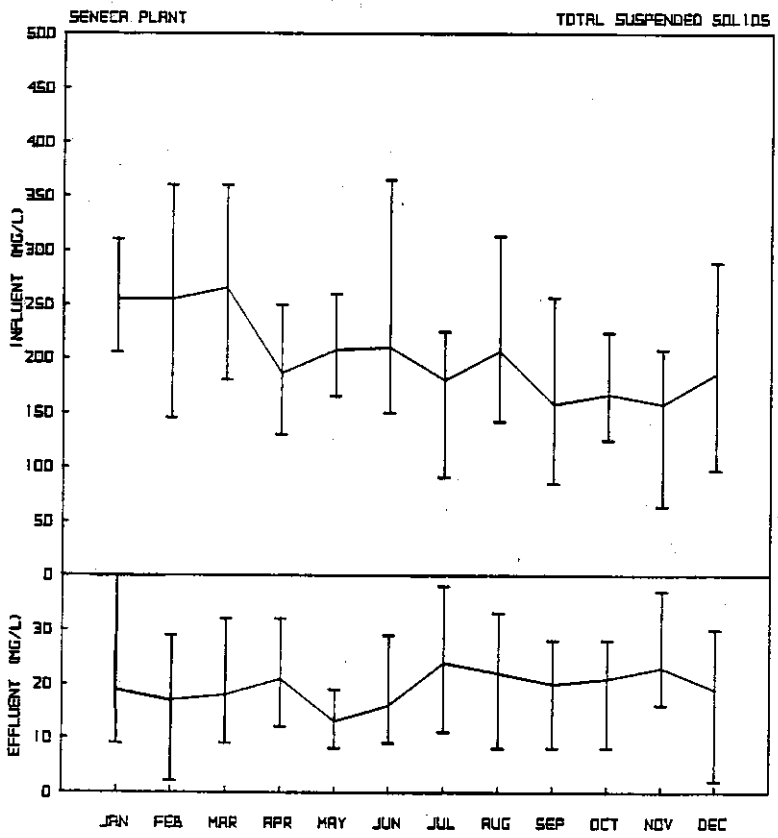
Month	TBOD mg/l	CBOD mg/l	COD mg/l	TSS mg/l	FECAL COLI Geo Mean no/100 ml	TURB NTU	KJN mg/l	NH_3 mg/l	NO_2 mg/l	NO_3 mg/l	Total P mg/l	Cl2 Used lbs	Cl2 Res mg/l	DO mg/l	pH Range	% Removal BOD	% Removal TSS
NPDES LIMIT	25	25	--	30	200	25	----	----	----	----	---	---	---	---	6.5-8.5	--	--
JANUARY	19	18	80	19	---	7	28.1	23.0	0.26	0.30	3.9	---	---	9.1	6.8-7.6	93	93
FEBRUARY	16	16	82	17	---	7	28.4	21.3	0.09	0.15	3.6	---	---	9.2	6.9-7.3	93	93
MARCH	22	21	92	18	2	8	27.3	20.7	0.08	0.10	2.7	511	0.8	9.3	6.4-7.1	91	93
APRIL	25	25	99	21	3	9	26.4	20.3	0.06	0.09	3.4	520	0.7	9.9	6.8-7.3	88	89
MAY	22	19	83	13	7	7	27.3	21.7	0.07	0.06	2.8	512	0.7	7.9	6.8-7.7	91	94
JUNE	22	17	82	16	5	9	27.3	19.6	0.05	0.07	3.3	496	0.8	5.4	6.8-7.6	91	92
JULY	34	19	83	24	10	11	24.6	16.6	0.73	0.08	3.7	484	0.7	6.7	6.9-7.2	92	87
AUGUST	29	15	71	22	9	10	21.7	13.8	2.38	0.15	2.3	432	0.4	6.1	6.9-7.7	93	89
SEPTEMBER	20	13	70	20	10	8	20.7	13.8	1.79	0.49	3.2	577	0.8	7.0	6.9-7.6	93	88
OCTOBER	25	16	74	21	8	9	24.1	15.0	1.11	0.30	4.3	611	0.7	6.7	7.2-7.6	93	87
NOVEMBER	37	19	79	23	---	9	25.3	19.1	0.85	0.29	4.0	---	---	9.5	7.1-7.5	91	85
DECEMBER	22	20	79	19	---	7	27.2	21.8	0.14	0.38	3.6	---	---	8.8	7.1-7.4	92	90
1982 AVG.	24	18	81	19	7	8	25.7	18.9	0.63	0.20	3.4	518	0.7	8.0	6.4-7.7	92	90
1981 AVG.	20	--	88	20	4	9	27.2	20.8	0.24	0.08	3.7	912	3.2	7.8	6.7-8.0	91	91

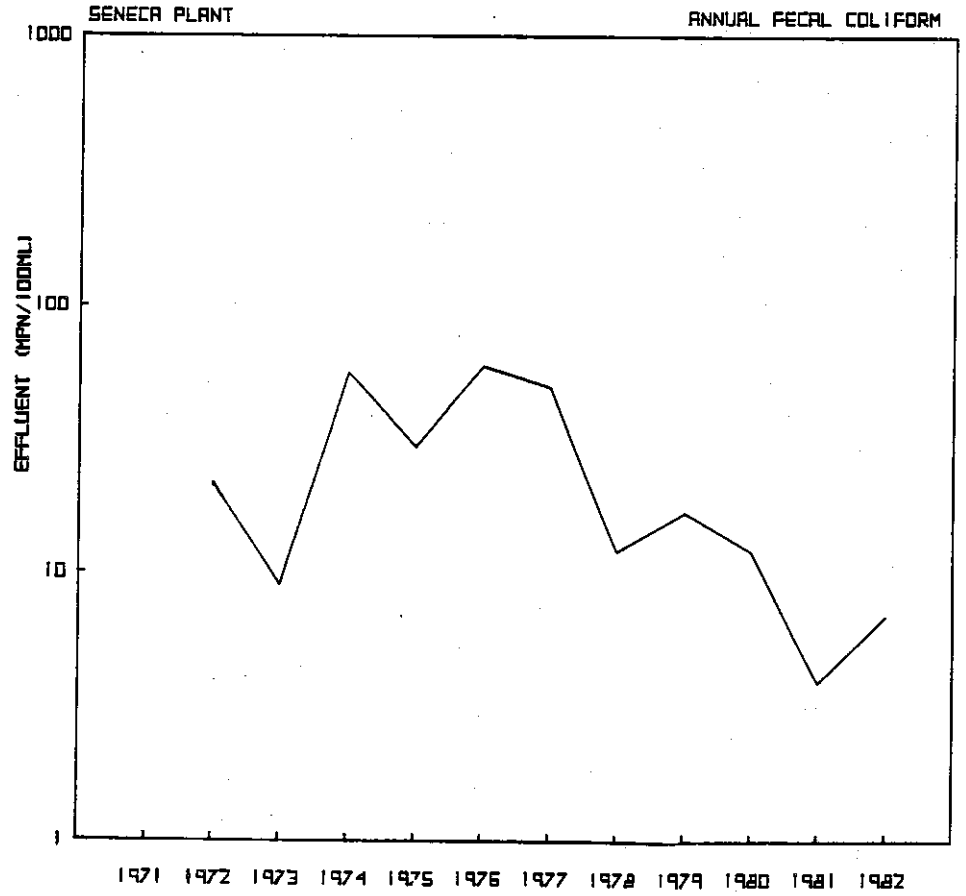


DATA REPRESENTS CBOD IN 1982. ALL PREVIOUS YEAR'S DATA ARE TBOD.




SENECA PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
EFFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
30
20
10
0
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982


SENECA PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
EFFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
30
20
10
0
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC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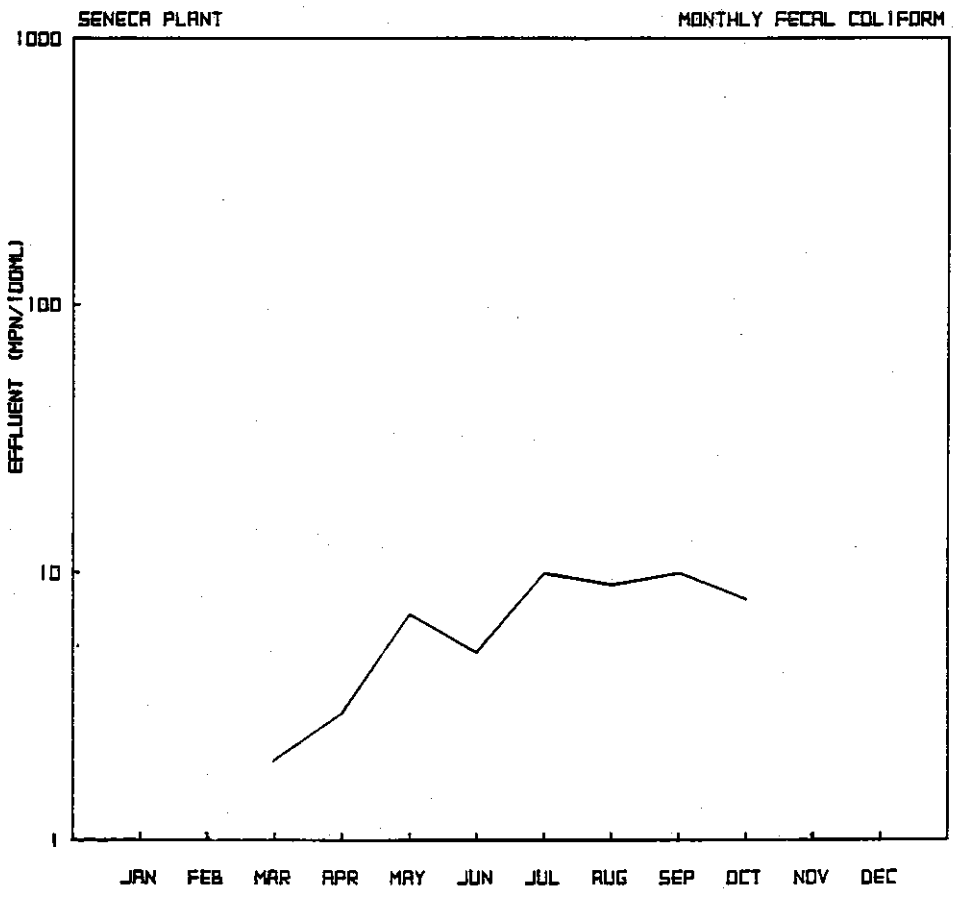
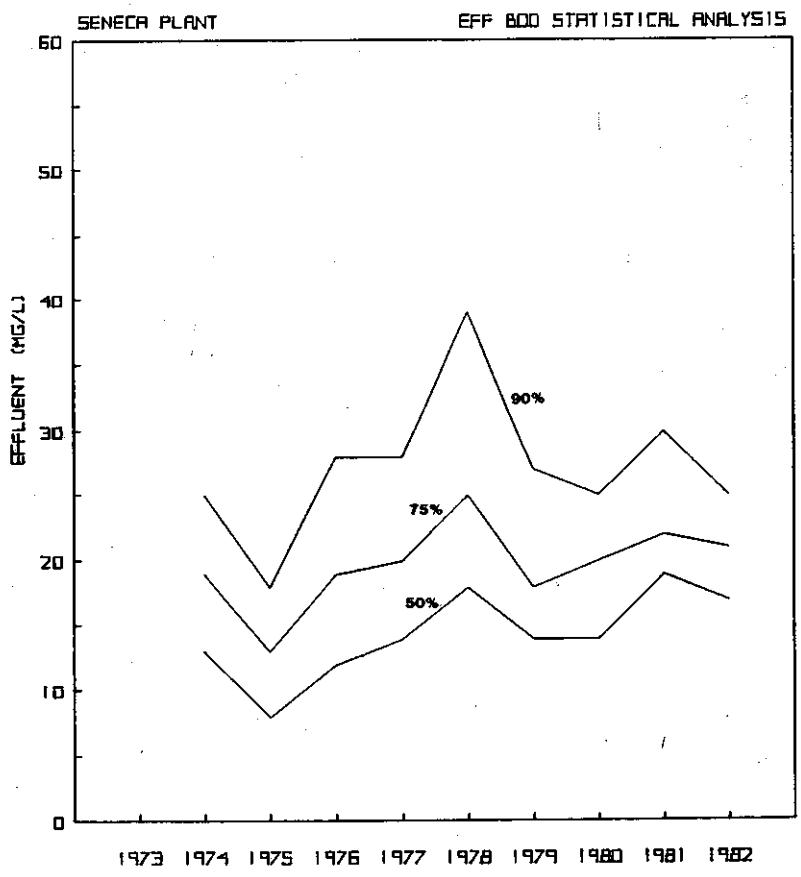
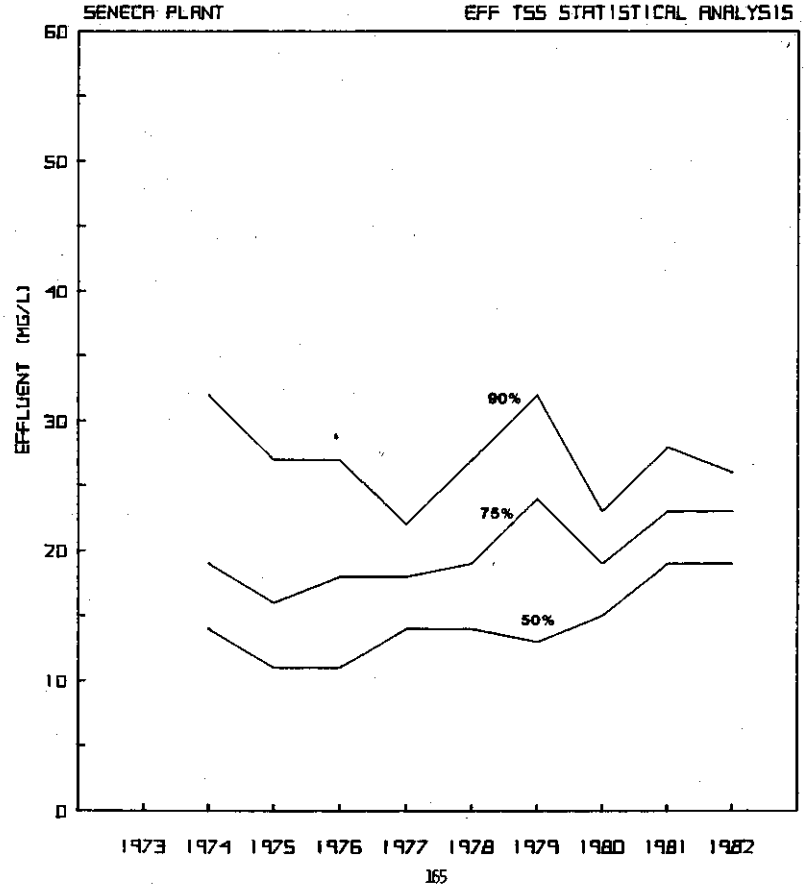
ANNUAL FECAL COLIFORM
EFFLUENT (MPN/100ML)
1000
100
10
1
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982


SENECA PLANT
MONTHLY FECAL COLIFORM
EFFLUENT (MPN/100ML)
1000
100
10
1
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC


SENECA PLANT
EFF BOD STATISTICAL ANALYSIS
EFFLUENT (MG/L)
60
50
40
30
20
10
0
90%
75%
50%
1973 1974 1975 1976 1977 1978 1979 1980 1981 1982


SENECA PLANT
EFF TSS STATISTICAL ANALYSIS
EFFLUENT (MG/L)
60
50
40
30
20
10
0
90%
75%
50%
1973 1974 1975 1976 1977 1978 1979 1980 1981 1982

STILLWATER WASTEWATER TREATMENT PLANT

Plant History and Description

The Stillwater Plant was originally constructed in 1959 as a primary treatment plant. In 1970, the plant was upgraded to include secondary treatment, and phosphorus removal facilities were added to the plant in 1973. The design capacity of the plant is 3.0 mgd. Actual operating capacity is somewhat less, due to the additional phosphorus removal facilities.

Liquid treatment consists of screening, grit removal, primary sedimentation, activated sludge aeration, alum addition for phosphorus removal, final clarification, chlorination, and discharge to Lake St. Croix (St. Croix River).

Solids processing consists of combined thickening in primary tanks, anaerobic digestion, and sludge hauling to either the Metropolitan Plant Interceptor System or sludge landspreading sites. The plant is presently operating at about 85 percent of its design capacity and is subject to secondary treatment limits and a phosphorus limit of 1 mg/L.

Performance

Plant flow averaged 2.61 mgd during 1982, up slightly from 2.30 mgd in 1981. Average plant effluent quality was 10 mg/L BOD, 8 mg/L TSS and 0.4 mg/L P. Plant performance was excellent throughout the year, as no NPDES Permit violations were experienced. Statistical analysis of data show the following trend in BOD and TSS from 1979 through 1982.

Effluent Concentration, mg/l

	50% of Time				75% of Time				90% of Time			
	1979	1980	1981	1982	1979	1980	1981	1982	1979	1980	1981	1982
BOD	8	12	14	10	12	14	24	12	21	19	33	14
TSS	10	9	8	8	12	14	12	10	16	21	15	12

Future

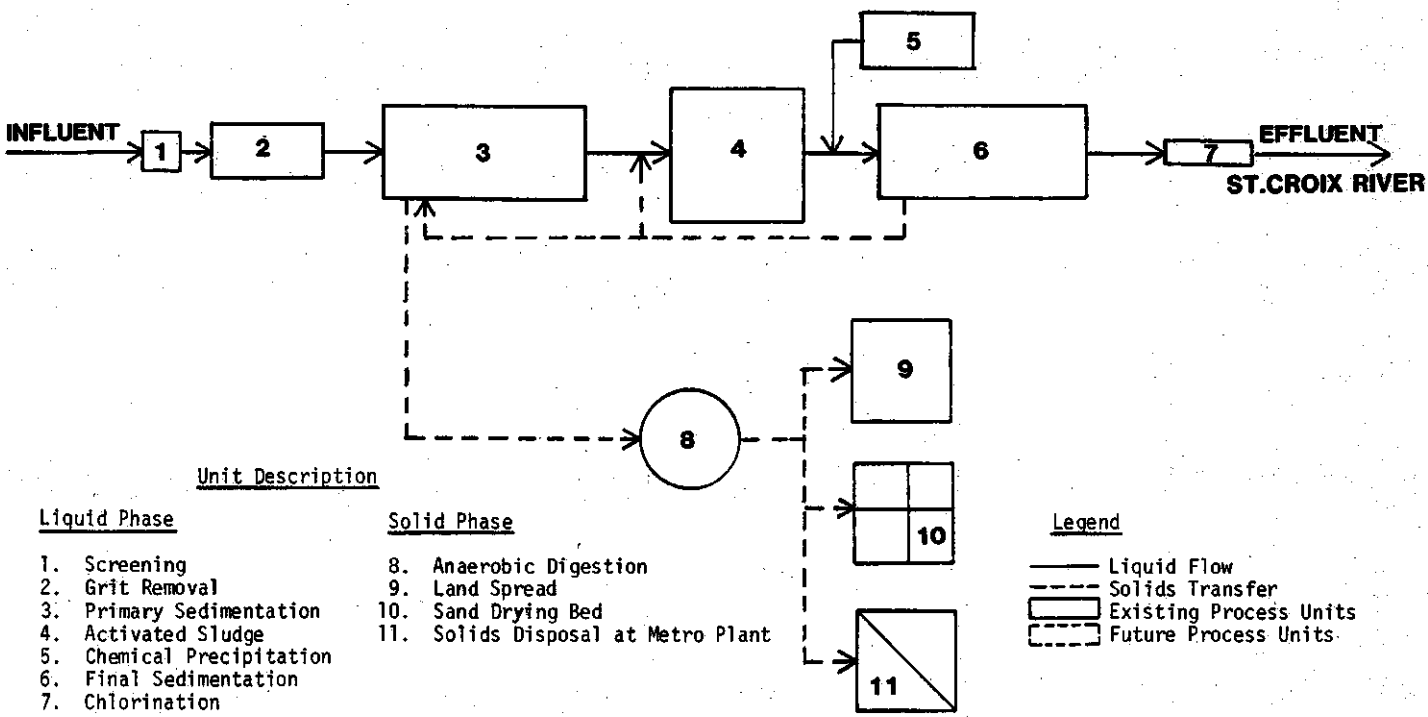
The Stillwater Plant is considered a permanent plant. The plant is expected to be expanded in the late 1980's to allow for the inclusion of flow from the City of Bayport and increased flow from the present service area.

STILLWATER PLANT PROCESS UNIT LOADINGS
1982

Parameter	Annual Average	Maximum Month
Wastewater Flow, MGD	2.61	3.16
BOD Loading, lb/day	2,940	3,290
TSS Loaidng, lb/day	3,050	3,940
COD Loading, lb/day	5,350	5,920
Primary Sedimentation		
Detention Times, Hrs.	2.3	1.9
Weir Overflow Rate, gpd/Lin. Ft.	10,700	13,000
Surface Overflow Rate, gpd/Sq. Ft.	594	719
Aeration Basin		
BOD Loading, lb/Day/1000 Cu. Ft.	54	61
Alum Feed Rate, lb/day	399	416
Final Sedimentation		
Detention Time, Hr.	2.7	2.2
Weir Overflow Rate, gpd/Lin. Ft.	8,310	10,100
Surface Overflow Rate, gpd/Sq. Ft.	665	805
Chlorination		
Contact Time, Minutes	36	30
Chlorine Use, lb/day	48	56
Anaerobic Digestors		
Solid Detention Time, Days	27	24
Sludge Transport		
Volume, gpd	13,800	19,500
Mass, lb/day	3,090	4,220

STILLWATER WASTEWATER TREATMENT PLANT

FLOW DIAGRAM



Unit Description

Liquid Phase

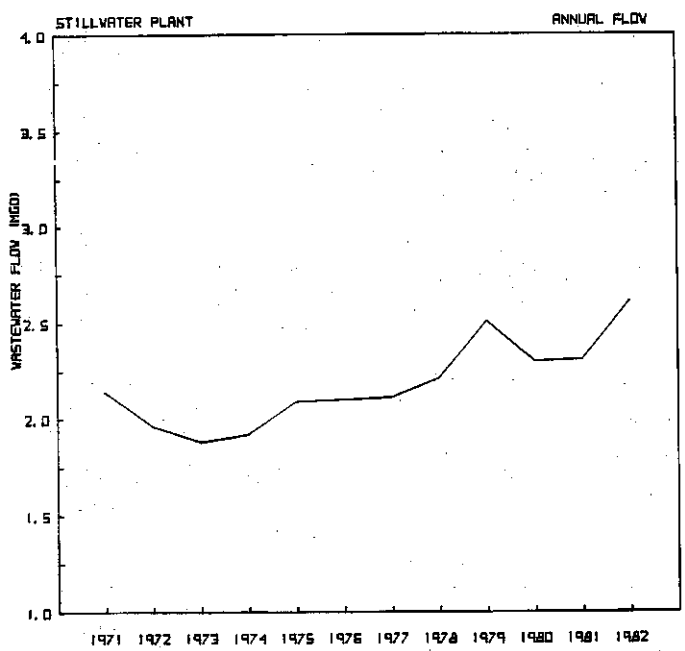
1. Screening
2. Grit Removal
3. Primary Sedimentation
4. Activated Sludge
5. Chemical Precipitation
6. Final Sedimentation
7. Chlorination

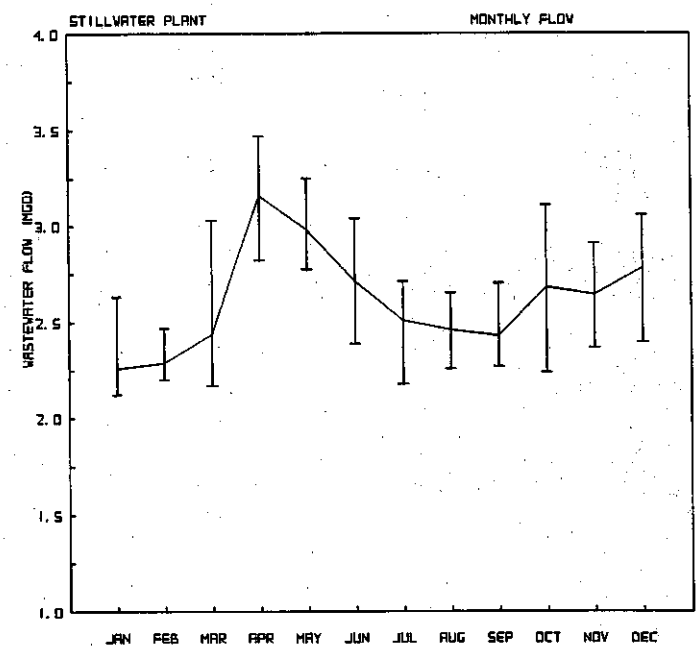
Solid Phase

8. Anaerobic Digestion
9. Land Spread
10. Sand Drying Bed
11. Solids Disposal at Metro Plant

Legend

- Liquid Flow
- Solids Transfer
- Existing Process Units
- Future Process Units



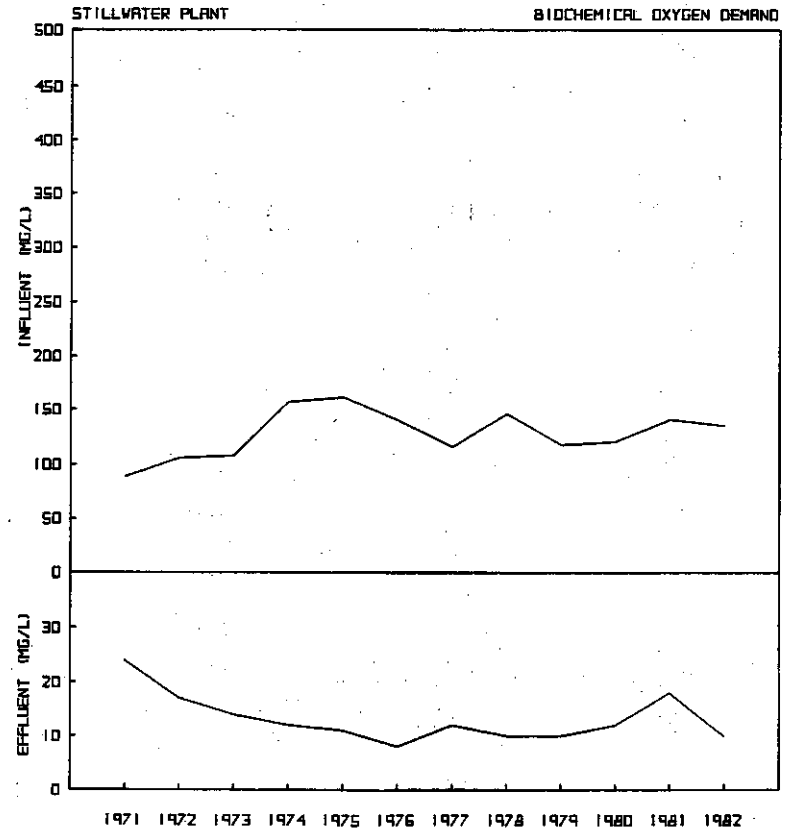


MONTHLY SUMMARY OF INFLUENT QUALITY
TREATMENT PLANT: Stillwater

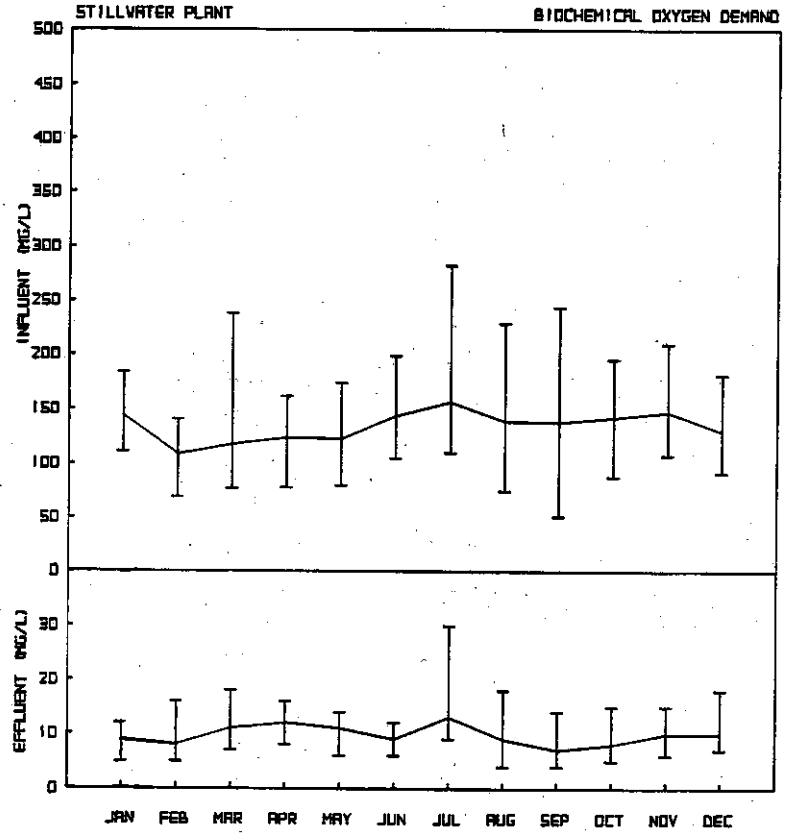
Month	Wastewater Flow, MGD	Temperature °C	TBOD mg/l	TSS mg/l	pH Range	KJN mg/l	Total-P mg/l	NH_3 mg/l	COD mg/l
JANUARY	2.26	10	144	126	6.6-8.9	25.9	5.6	15.4	262
FEBRUARY	2.29	12	109	112	6.8-9.6	26.5	4.7	13.8	226
MARCH	2.44	10	118	150	4.8-9.6	23.4	5.6	14.1	216
APRIL	3.16	10	124	116	6.4-9.6	17.2	4.0	10.1	224
MAY	2.98	12	123	137	6.8-9.0	19.4	4.5	10.8	226
JUNE	2.71	15	144	123	6.6-9.3	24.8	4.8	13.0	254
JULY	2.51	16	157	150	6.7-9.2	23.7	5.3	11.2	277
AUGUST	2.46	17	139	171	6.8-9.0	25.6	5.5	11.6	264
SEPTEMBER	2.43	16	138	134	6.0-8.9	27.2	5.3	12.8	258
OCTOBER	2.68	15	143	151	3.8-8.6	22.1	5.0	9.7	252
NOVEMBER	2.64	13	148	179	4.0-8.2	24.8	5.0	14.8	271
DECEMBER	2.78	13	130	118	6.6-8.4	23.4	4.5	14.4	224
1982 AVERAGE	2.61	13	135	139	3.8-9.6	23.6	5.0	12.6	246
1981 AVERAGE	2.30	14	141	159	4.4-9.8	----	---	-----	264

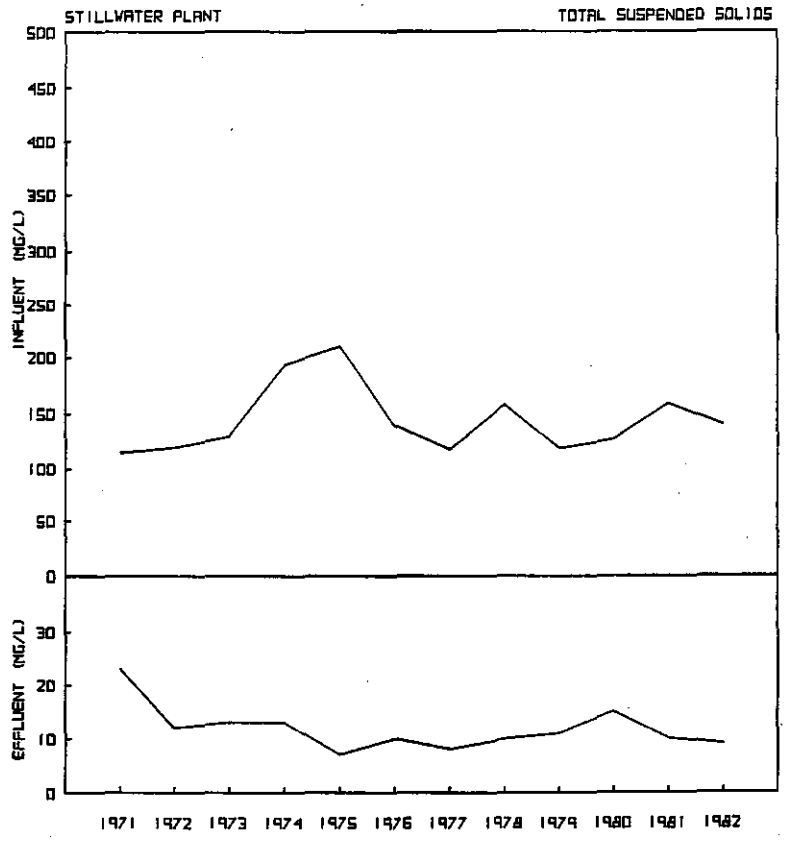
MONTHLY SUMMARY OF EFFLUENT QUALITY
TREATMENT PLANT: Stillwater

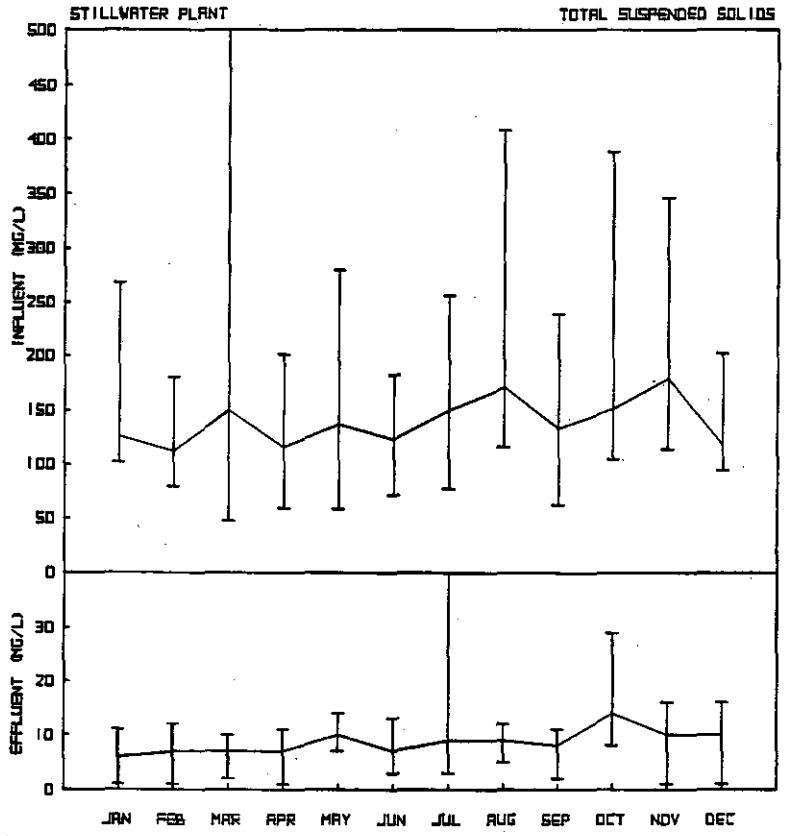
Month	TBOD mg/l	CBOD mg/l	COD mg/l	TSS mg/l	FECAL COLI Geo Mean no/100 ml	TURB NTU	KJN mg/l	NH_3 mg/l	NO_2 mg/l	NO_3 mg/l	Total P mg/l	Cl2 Used lbs	Cl2 Res mg/l	DO mg/l	pH Range	% Removal BOD	% Removal TSS
NPDES LIMIT	25	25	--	30	200	25	----	----	-----	----	1.0	--	---	---	6.5-8.5	--	--
JANUARY	10	9	31	6	---	4	17.3	14.1	0.40	1.70	0.3	--	---	5.3	6.9-7.1	94	96
FEBRUARY	10	8	37	7	---	4	18.8	12.9	0.44	1.94	0.3	--	---	4.9	7.0-7.1	92	94
MARCH	18	11	39	7	1	4	15.5	10.2	1.49	1.39	0.3	50	1.7	5.0	7.0-7.1	91	96
APRIL	22	12	34	7	2	4	10.4	8.4	2.13	1.04	0.3	50	1.4	5.1	6.5-7.2	90	94
MAY	17	11	34	10	2	5	12.4	8.1	0.77	0.56	0.4	50	1.9	5.3	7.0-7.1	91	93
JUNE	25	9	45	7	3	6	10.6	7.3	3.71	0.81	0.4	50	2.1	5.0	7.0-7.2	94	95
JULY	31	13	46	9	3	5	15.6	10.9	2.00	0.89	0.4	50	2.0	4.9	7.0-7.1	91	94
AUGUST	24	9	34	9	6	6	13.7	9.8	0.94	1.65	0.6	50	2.0	5.0	6.8-7.2	93	95
SEPTEMBER	13	7	31	8	9	5	16.3	11.0	0.38	1.71	0.4	50	2.2	5.1	6.9-7.1	95	94
OCTOBER	17	8	34	14	14	6	15.0	9.3	0.36	1.79	0.7	56	2.3	5.2	7.0-7.1	95	91
NOVEMBER	12	10	33	10	---	4	15.5	13.4	0.45	0.94	0.6	--	---	5.2	7.0-7.1	94	95
DECEMBER	11	10	35	10	---	4	14.9	12.5	0.18	1.40	0.5	--	---	5.1	7.0-7.1	92	92
1982 AVG.	17	10	36	8	5	5	14.7	10.6	1.10	1.32	0.4	51	2.0	5.1	6.5-7.2	93	94
1981 AVG.	18	--	36	10	2	5	14.5	10.5	1.72	0.89	0.5	112	3.7	4.3	7.0-7.2	87	94

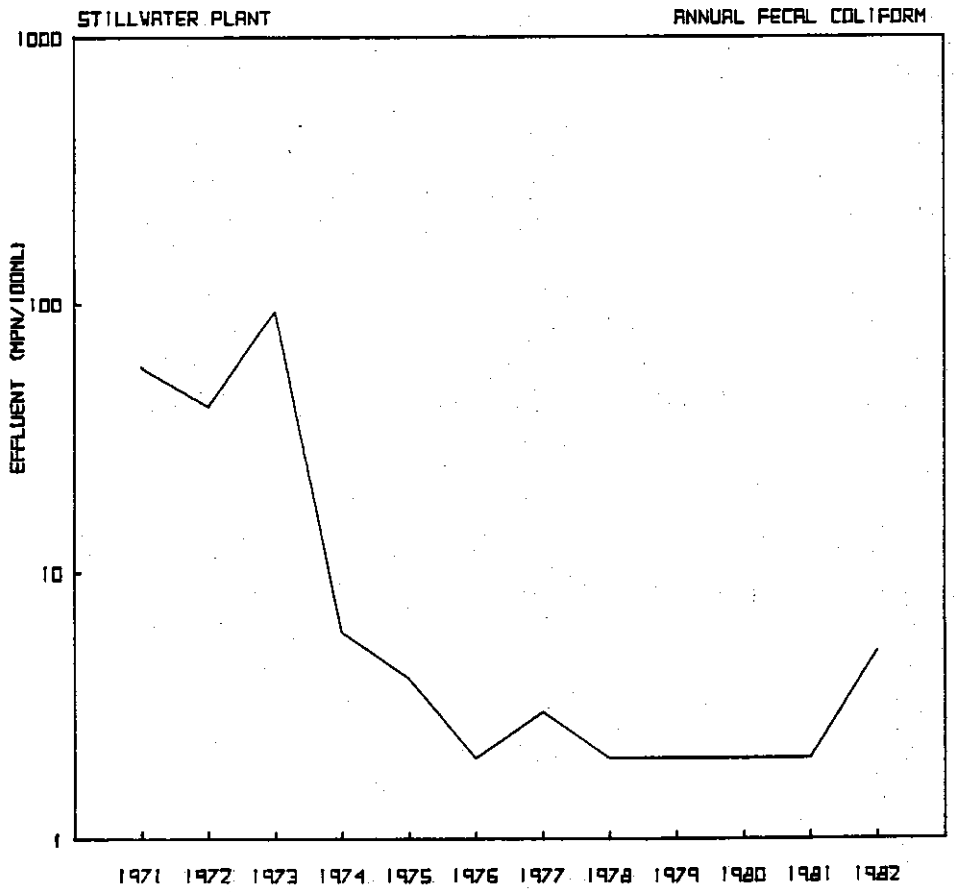


DATA REPRESENTS CBOD IN 1982. ALL PREVIOUS YEAR'S DATA ARE TBOD.




STILLWATER PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
EFFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
30
20
10
0
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982


STILLWATER PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
EFFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
30
20
10
0
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC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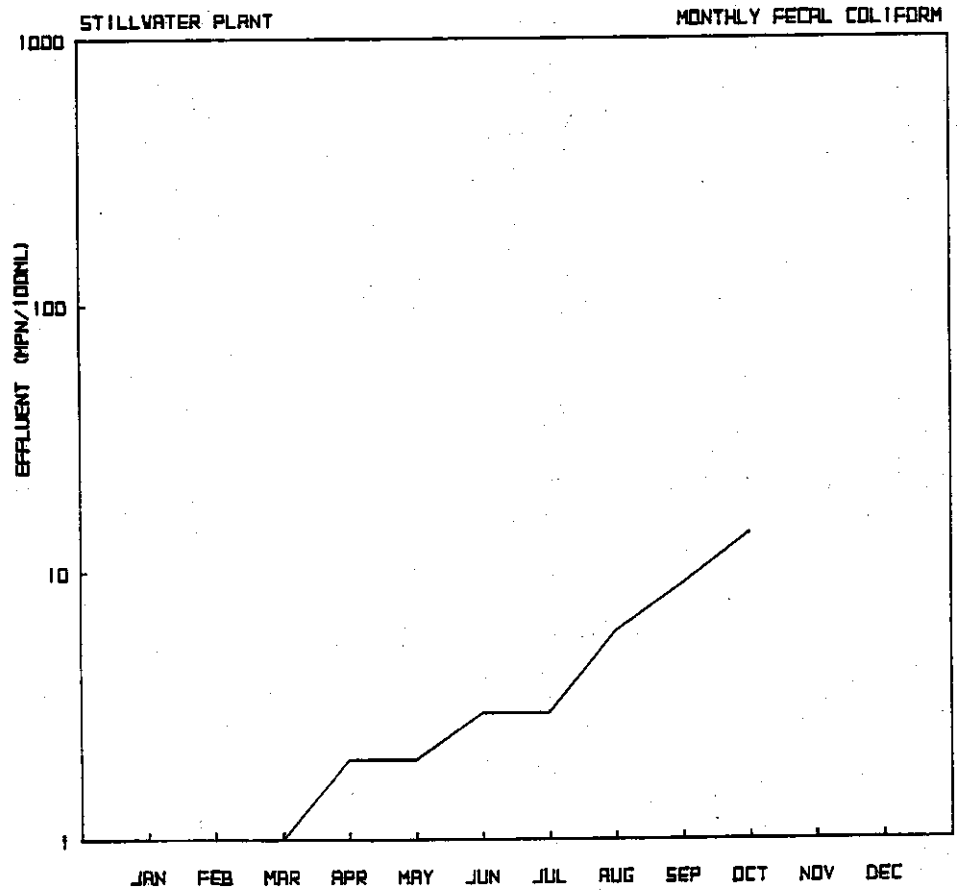
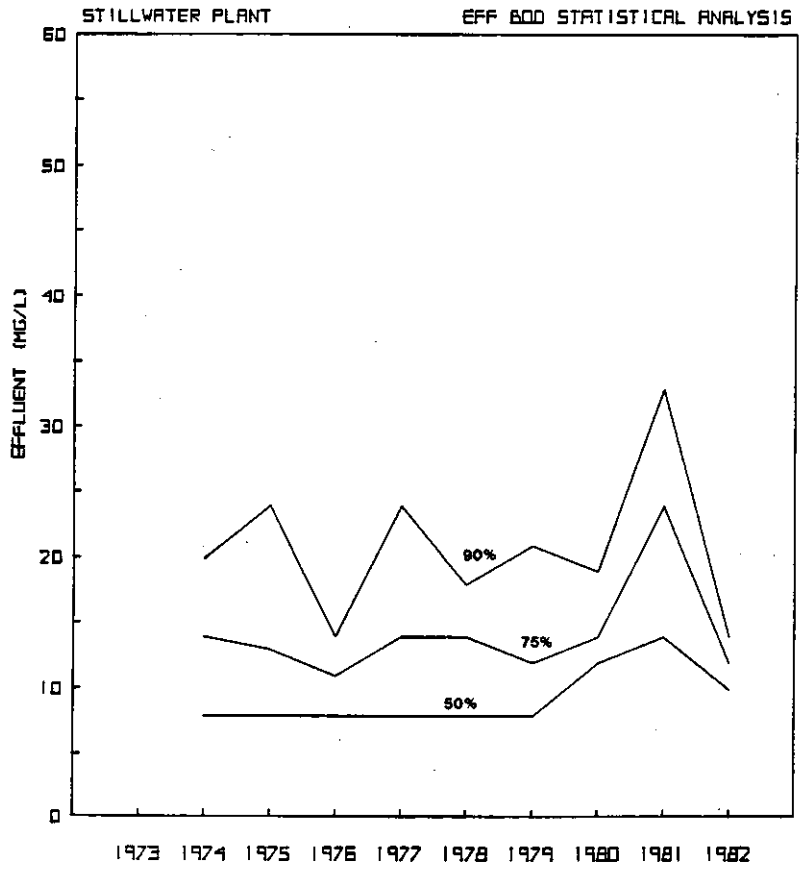
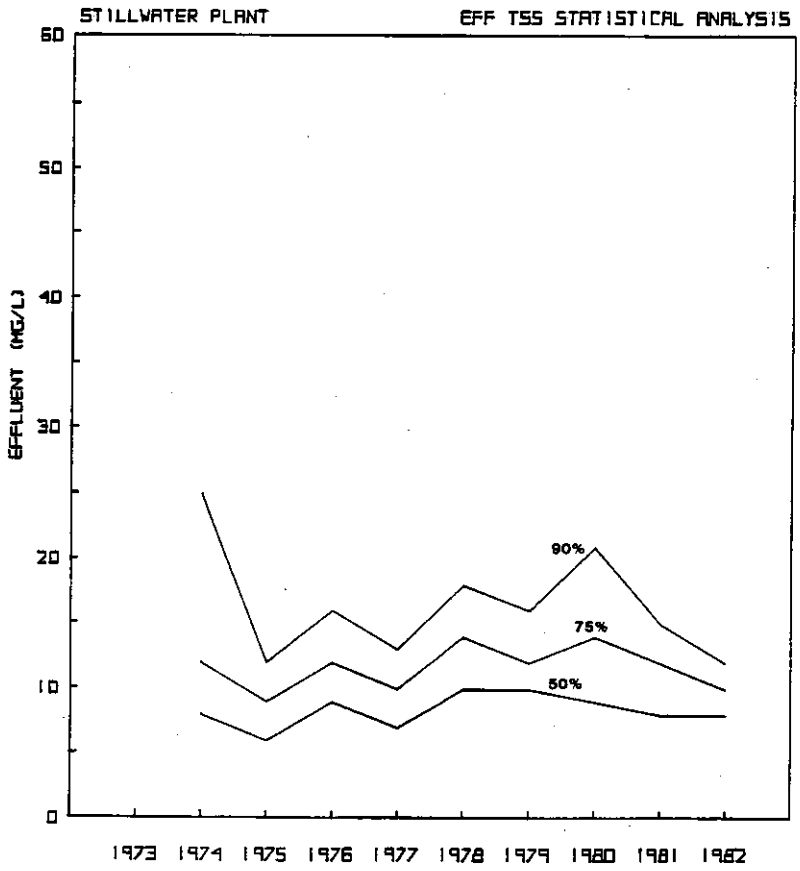
ANNUAL FECAL COLIFORM
1000
100
10
1
EFFLUENT (MPN/100ML)
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982


STILLWATER PLANT
MONTHLY FECAL COLIFORM
1000
100
10
1
EFFLUENT (MPN/100ML)
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


STILLWATER PLANT
EFF BOD STATISTICAL ANALYSIS
EFFLUENT (MG/L)
60
50
40
30
20
10
0
90%
75%
50%
1973 1974 1975 1976 1977 1978 1979 1980 1981 1982


STILLWATER PLANT
EFF TSS STATISTICAL ANALYSIS
EFFLUENT (MG/L)
60
50
40
30
20
10
0
90%
75%
50%
1973 1974 1975 1976 1977 1978 1979 1980 1981 1982

1982 EFFLUENT DATA
TREATMENT PLANT Stillwater

MONTH	Cu mg/l	Cr mg/l	Zn mg/l	Pb mg/l	Cd mg/l	Hg ug/l	CN mg/l	As ug/l	Sn mg/l	Ni mg/l	Phenol ug/l	Fe mg/l	PCB ug/l
January						<0.20							
February						<0.20							
March						<0.10							
April						----							
May						<0.20							
June						<0.20							
July						<0.20							
August						<0.20							
September						----							
October						<0.20							
November						<0.20							
December						<0.20							
1982 Avg.						<0.19							

APPENDIX

TABLE A-1

1982 ANNUAL AVERAGE
TREATMENT PLANT INFLUENT DATA

Treatment Plant	Flow mgd	Temp °C	TBOD mg/l	COD mg/l	TSS mg/l	pH Range	Nutrients Total P mg/l	Nutrients KJN mg/l	Nutrients NH3 mg/l
Anoka	2.14	17	223	356	154	7.0-8.4	6.8	37.9	20.3
Bayport	0.52	20	161	283	150	5.0-10.0	5.5	28.4	15.9
Blue Lake	16.1	14	228	500	230	6.3-8.1	7.0	33.1	14.6
Chaska	0.80	14	189	356	167	5.6-11.2	5.6	32.7	16.0
Cottage Grove	1.26	15	208	397	173	7.2-8.7	7.6	46.1	26.5
Empire	4.05	14	204	401	212	5.7-10.2	13.3	39.0	21.8
Hastings	1.50	16	251	541	233	3.0-12.0	11.1	46.9	26.0
Maple Plain	0.35	13	146	299	199	6.9-7.9	5.5	37.9	18.1
Medina	0.149	13	122	231	127	7.5-7.9	4.2	31.7	14.3
Metropolitan	208	16	203	415	241	5.7-9.4	4.9	30.6	16.4
Rosemount	0.31	14	168	421	239	6.0-11.0	7.4	49.0	27.1
Savage	0.48	13	151	281	170	0.2-13.6	6.4	27.0	15.1
Seneca	14.7	16	221	456	203	6.3-8.5	7.8	39.4	21.3
Stillwater	2.61	13	135	246	139	3.8-9.6	5.0	23.6	12.6

TABLE A-2

ANNUAL AVERAGE FLOW DATA
FOR THE PERIOD 1971-1982

Treatment Plant	ANNUAL AVERAGE FLOW (MGD)											
	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
ANOKA	1.76	1.93	1.88	1.78	1.62	1.77	1.92	2.01	1.98	2.09	2.01	2.14
APPLE VALLEY	0.57	0.71	1.16	1.26	1.48	1.46	1.67	1.94	2.03	*---	----	----
BAYPORT	0.48	0.48	0.42	0.45	0.56	0.50	0.48	0.47	0.54	0.44	0.47	0.52
BLUE LAKE (POND)	1.43	2.96	3.74	----	-----	-----	-----	-----	----	----	----	----
BLUE LAKE	----	----	3.94	6.78	9.05	9.03	9.86	12.49	14.1	14.1	13.7	16.1
BURNSVILLE	1.76	2.10	*----	----	-----	-----	-----	-----	----	----	----	----
CHASKA	0.53	0.58	0.74	0.75	0.91	0.81	0.75	0.97	0.89	0.64	0.70	0.80
CHANHASSEN	0.07	*---	-----	----	-----	-----	-----	-----	----	----	----	----
COTTAGE GROVE	0.62	0.85	0.92	0.91	0.91	0.91	0.97	1.31	1.60	1.58	1.21	1.26
**EAGAN TOWNSHIP	-----	----	*----	----	-----	-----	-----	-----	----	----	----	----
EMPIRE	-----	----	-----	----	-----	-----	-----	-----	3.54	3.48	3.51	4.05
EXCELSIOR	0.56	0.50	*----	----	-----	-----	-----	-----	----	----	----	----
FARMINGTON	0.35	0.30	0.40	0.35	0.59	0.37	0.35	0.52	0.78	*---	----	----
FOREST LAKE TOWNSHIP	0.16	0.17	*----	----	-----	-----	-----	-----	----	----	----	----
FOREST LAKE VILLAGE	0.23	0.25	*----	----	-----	-----	-----	-----	----	----	----	----
HASTINGS	0.91	1.14	1.32	1.29	1.29	1.30	1.40	1.42	1.35	1.44	1.50	1.50
INVER GROVE HEIGHTS	0.59	0.64	*----	----	-----	-----	-----	-----	----	----	----	----
LAKEVILLE	0.45	0.36	0.33	0.37	0.50	0.38	0.36	0.48	0.60	*---	----	----
LONG LAKE	0.18	0.17	0.15	0.20	0.23	0.19	0.21	0.30	0.32	0.28	*---	----
MAPLE PLAIN	0.22	0.28	0.22	0.24	0.33	0.22	0.18	0.26	0.27	0.20	0.25	0.35
MEDINA	0.07	0.09	0.07	0.08	0.09	0.07	0.08	0.14	0.12	0.10	0.10	0.15
METROPOLITAN	213	213	202	196	202	196	194	210	217	206	202	208
MOUND	1.09	1.23	1.26	1.48	*----	-----	-----	-----	----	----	----	----
NEWPORT	0.18	0.17	0.18	0.17	0.21	*----	-----	-----	----	----	----	----
OAK PARK HEIGHTS	0.07	0.10	0.12	*---	-----	-----	-----	-----	----	----	----	----
ORONO	0.20	0.25	0.27	0.34	0.32	0.31	0.34	0.46	0.49	0.62	*---	----
PRIOR LAKE	0.10	0.12	0.13	0.17	0.31	0.44	0.10	0.01	*---	----	----	----
ROSEMOUNT (trickling filter)	0.10	0.11	0.12	*---	-----	-----	-----	-----	----	----	----	----
ROSEMOUNT AWTP	-----	----	0.20	0.20	0.22	0.24	0.27	0.29	0.30	0.29	0.30	0.31
ST. PAUL PARK	0.30	0.31	0.30	0.28	0.36	*----	----	-----	----	----	----	----
SAVAGE	0.31	0.33	0.29	0.38	0.42	0.38	0.39	0.37	0.44	0.38	0.40	0.48
SENECA	-----	7.76	10.12	9.89	10.34	10.81	11.72	12.71	13.6	13.0	13.8	14.7
SHAKOPEE	1.24	*---	-----	----	-----	-----	-----	-----	----	----	----	----
SOUTH ST. PAUL	10.10	9.38	9.66	9.72	*----	-----	-----	-----	----	----	----	----
STILLWATER	2.14	1.96	1.88	1.92	2.09	2.10	2.11	2.21	2.51	2.30	2.31	2.61
**VICTORIA	-----	----	-----	*---	-----	-----	-----	-----	----	----	----	----
WACONIA	-----	----	-----	----	0.23	0.26	0.25	*----	----	----	----	----
WAYZATA	0.53	*---	-----	----	-----	-----	-----	-----	----	----	----	----
ALL PLANTS EXCEPT METRO	26	31	36	39	32	32	33	39	45	41	40	45
ALL PLANTS	239	244	238	235	234	228	227	249	262	247	242	253

* Plant phased out during previous year.
**Flow data not available.

TABLE A-3

ANNUAL AVERAGE EFFLUENT CONCENTRATIONS
FOR THE PERIOD 1971-1982

Treatment Plant	ANNUAL AVERAGE BOD (MG/L)											
	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982**
ANOKA	20	29	36	21	16	11	9	12	14	14	16	12
APPLE VALLEY	74	113	22	24	7	7	6	12	23	*--	---	---
BAYPORT	27	40	32	9	15	14	11	8	7	7	8	8
BLUE LAKE (POND)	31	31	39	---	---	---	---	---	---	---	---	---
BLUE LAKE	---	---	12	18	15	15	13	13	9	9	12	10
BURNSVILLE	40	55	*--	---	---	---	---	---	---	---	---	---
CHASKA	36	49	52	58	43	42	44	78	112	20	18	14
CHANHASSEN	84	*--	---	---	---	---	---	---	---	---	---	---
COTTAGE GROVE	53	52	60	36	25	55	39	34	19	11	12	10
EAGAN TOWNSHIP	50	52	*--	---	---	---	---	---	---	---	---	---
EMPIRE	---	---	---	---	---	---	---	---	10	3	3	2
EXCELSIOR	13	26	*--	---	---	---	---	---	---	---	---	---
FARMINGTON	39	52	46	85	64	29	76	31	52	*--	---	---
FOREST LAKE TOWNSHIP	8	35	*--	---	---	---	---	---	---	---	---	---
FOREST LAKE VILLAGE	77	114	*--	---	---	---	---	---	---	---	---	---
HASTINGS	12	7	15	34	15	12	16	18	18	18	20	20
INVER GROVE HEIGHTS	76	110	*--	---	---	---	---	---	---	---	---	---
LAKEVILLE	36	33	34	25	28	34	51	67	65	*--	---	---
LONG LAKE	53	24	18	35	40	41	43	42	43	58	*--	---
MAPLE PLAIN	12	11	13	10	9	8	11	11	18	20	12	13
MEDINA	12	9	14	10	13	14	25	22	22	22	26	14
METROPOLITAN	84	72	46	42	41	67	42	39	43	23	19	13
MOUND	24	35	53	98	*--	---	---	---	---	---	---	---
NEWPORT	48	88	58	47	49	*--	---	---	---	---	---	---
OAK PARK HEIGHTS	39	32	48	*--	---	---	---	---	---	---	---	---
ORONO	15	10	10	6	6	8	12	24	18	31	*--	---
PRIOR LAKE	34	26	28	22	24	35	22	24	*--	---	---	---
ROSEMOUNT (trickling filter)	36	68	76	*--	---	---	---	---	---	---	---	---
ROSEMOUNT AWTP	---	---	7	23	16	14	14	13	13	12	14	16
ST. PAUL PARK	66	93	52	51	63	*--	---	---	---	---	---	---
SAVAGE	22	26	28	27	21	20	46	27	27	7	10	8
SENECA	---	29	16	15	11	15	16	21	16	16	20	18
SHAKOPEE	355	*--	---	---	---	---	---	---	---	---	---	---
SOUTH ST. PAUL	60	42	31	46	*--	---	---	---	---	---	---	---
STILLWATER	24	17	14	12	11	8	12	10	10	12	18	10
VICTORIA	73	52	70	*--	---	---	---	---	---	---	---	---
WACONIA	---	---	---	---	17	62	52	31	*--	---	---	---
WAYZATA	41	*--	---	---	---	---	---	---	---	---	---	---
ALL PLANTS EXCEPT METRO (weighted avg.)	52	38	27	26	16	17	17	19	17	12	15	13
ALL PLANTS (weighted average)	81	67	43	40	38	60	38	36	39	21	18	12
ALL PLANTS EXCEPT METRO (actual average)	50	45	34	32	24	23	27	26	28	17	15	12
ALL PLANTS (actual average)	51	46	34	33	25	26	28	27	28	18	15	12

* Plant phased out during previous year.
**$CBOD_5$ values listed for 1982.

TABLE A-4

ANNUAL AVERAGE EFFLUENT CONCENTRATIONS
FOR THE PERIOD 1971-1982

Treatment Plant	ANNUAL AVERAGE TSS (MG/L)											
	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
ANOKA	24	36	40	19	13	15	14	16	12	11	14	8
APPLE VALLEY	93	148	16	14	5	5	3	6	10	*--	---	---
BAYPORT	22	43	28	15	10	8	10	8	8	7	7	8
BLUE LAKE (POND)	34	58	45	---	---	---	---	---	---	---	---	---
BLUE LAKE	---	---	22	21	14	19	13	14	12	9	6	7
BURNSVILLE	60	86	*--	---	---	---	---	---	---	---	---	---
CHASKA	72	86	79	91	62	55	54	66	59	12	13	11
CHANHASSEN	71	*--	---	---	---	---	---	---	---	---	---	---
COTTAGE GROVE	63	70	93	84	36	25	23	28	14	8	7	7
EAGAN TOWNSHIP	60	69	*--	---	---	---	---	---	---	---	---	---
EMPIRE	---	---	---	---	---	---	---	---	5	2	2	1
EXCELSIOR	13	36	*--	---	---	---	---	---	---	---	---	---
FARMINGTON	70	77	54	75	29	23	34	34	37	*--	---	---
FOREST LAKE TOWNSHIP	11	24	*--	---	---	---	---	---	---	---	---	---
FOREST LAKE VILLAGE	105	163	*--	---	---	---	---	---	---	---	---	---
HASTINGS	10	10	18	26	20	21	18	20	19	23	22	31
INVER GROVE HEIGHTS	139	174	*--	---	---	---	---	---	---	---	---	---
LAKEVILLE	47	36	36	30	33	39	53	68	71	*--	---	---
LONG LAKE	35	47	23	50	39	48	37	30	26	43	*--	---
MAPLE PLAIN	20	13	13	19	12	16	16	10	13	14	9	7
MEDINA	11	15	16	13	13	15	20	18	19	25	18	14
METROPOLITAN	72	54	37	43	40	60	49	43	64	26	19	11
MOUND	37	36	47	38	*--	---	---	---	---	---	---	---
NEWPORT	85	120	96	110	89	*--	---	---	---	---	---	---
OAK PARK HEIGHTS	36	47	85	*--	---	---	---	---	---	---	---	---
ORONO	19	15	10	10	11	17	21	32	23	43	*--	---
PRIOR LAKE	28	33	27	25	25	28	17	17	*--	---	---	---
ROSEMOUNT (trickling filter)	51	63	58	*--	---	---	---	---	---	---	---	---
ROSEMOUNT AWTP	---	---	2	9	4	3	3	4	3	2	2	2
ST. PAUL PARK	69	77	47	48	47	*--	---	---	---	---	---	---
SAVAGE	24	28	14	15	13	10	14	15	14	7	8	4
SENECA	---	29	17	19	16	15	15	17	20	16	20	19
SHAKOPEE	146	*--	---	---	---	---	---	---	---	---	---	---
SOUTH ST. PAUL	38	22	22	31	*--	---	---	---	---	---	---	---
STILLWATER	23	12	13	13	7	10	8	10	11	15	10	8
VICTORIA	59	45	52	*--	---	---	---	---	---	---	---	---
WACONIA	---	---	---	---	33	53	42	40	*--	---	---	---
WAYZATA	34	*--	---	---	---	---	---	---	---	---	---	---
ALL PLANTS EXCEPT METRO (weighted avg.)	44	38	27	26	17	18	15	18	16	12	14	11
ALL PLANTS (weighted average)	69	52	36	40	37	54	44	38	56	24	18	11
ALL PLANTS EXCEPT METRO (actual average)	50	57	37	35	25	22	22	24	21	16	11	10
ALL PLANTS (actual average)	51	57	37	36	26	24	23	25	23	16	12	10

* Plant phased out during previous year.

TABLE A-5

ANNUAL AVERAGE EFFLUENT PERCENT REMOVAL
EFFICIENCY FOR THE PERIOD 1971-1982

Treatment Plant	ANNUAL AVERAGE BOD REMOVAL (%)											
	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
ANOKA	89	87	85	91	92	94	95	94	93	92	92	95
APPLE VALLEY	65	52	90	89	97	96	97	94	88	*--	--	--
BAYPORT	88	86	86	97	95	95	95	96	96	96	96	95
BLUE LAKE (POND)	87	92	88	--	--	--	--	--	--	--	--	--
BLUE LAKE	--	--	96	94	94	95	95	95	96	96	95	95
BURNSVILLE	74	69	*--	--	--	--	--	--	--	--	--	--
CHASKA	79	75	74	69	81	83	78	61	57	91	92	93
CHANHASSEN	70	*--	--	--	--	--	--	--	--	--	--	--
COTTAGE GROVE	81	80	76	85	89	72	81	83	89	94	94	95
EAGAN TOWNSHIP	75	69	*--	--	--	--	--	--	--	--	--	--
EMPIRE	--	--	--	--	--	--	--	--	95	98	99	99
EXCELSIOR	92	91	*--	--	--	--	--	--	--	--	--	--
FARMINGTON	86	87	86	91	86	94	83	91	82	*--	--	--
FOREST LAKE TOWNSHIP	--	--	*--	--	--	--	--	--	--	--	--	--
FOREST LAKE VILLAGE	51	40	*--	--	--	--	--	--	--	--	--	--
HASTINGS	96	97	92	81	91	94	92	93	92	91	91	92
INVER GROVE HEIGHTS	66	51	*--	--	--	--	--	--	--	--	--	--
LAKEVILLE	75	78	84	94	92	94	88	77	75	*--	--	--
LONG LAKE	75	86	93	86	73	78	79	74	74	61	*--	--
MAPLE PLAIN	90	86	93	95	89	94	93	92	89	88	93	90
MEDINA	92	90	90	92	92	94	86	93	82	84	80	87
METROPOLITAN	66	73	82	84	83	75	83	82	79	89	91	95
MOUND	82	79	75	52	*--	--	--	--	--	--	--	--
NEWPORT	79	64	72	78	71	*--	--	--	--	--	--	--
OAK PARK HEIGHTS	85	88	83	*--	--	--	--	--	--	--	--	--
ORONO	88	93	94	96	94	93	91	79	82	68	*--	--
PRIOR LAKE	82	78	80	80	77	68	71	78	*--	--	--	--
ROSEMOUNT (trickling filter)	74	72	65	*--	--	--	--	--	--	--	--	--
ROSEMOUNT AWTP	--	--	90	91	92	94	93	93	93	93	92	90
ST. PAUL PARK	88	66	79	78	72	*--	--	--	--	--	--	--
SAVAGE	84	88	84	85	88	88	84	85	79	95	93	94
SENECA	--	88	94	94	95	94	93	92	93	92	91	92
SHAKOPEE	11	*--	--	--	--	--	--	--	--	--	--	--
SOUTH ST. PAUL	88	92	90	87	*--	--	--	--	--	--	--	--
STILLWATER	73	84	87	92	93	94	90	93	92	90	87	93
VICTORIA	57	68	66	*--	--	--	--	--	--	--	--	--
WACONIA	--	--	--	--	90	90	85	90	*--	--	--	--
WAYZATA	78	*--	--	--	--	--	--	--	--	--	--	--
ALL PLANTS EXCEPT METRO (weighted avg.)	83	85	89	90	93	93	93	92	92	94	93	94
ALL PLANTS (weighted average)	68	75	83	85	84	77	84	84	81	90	91	94
ALL PLANTS EXCEPT METRO (actual average)	77	78	84	86	88	89	88	87	86	89	92	94
ALL PLANTS (actual average)	77	78	84	86	88	89	88	87	86	89	92	94

* Plant phased out during previous year.

TABLE A-6

ANNUAL AVERAGE EFFLUENT PERCENT REMOVAL
EFFICIENCY FOR THE PERIOD 1971-1982

Treatment Plant	ANNUAL AVERAGE TSS REMOVAL (%)											
	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
ANOKA	90	88	85	94	94	92	92	90	91	92	91	95
APPLE VALLEY	64	55	95	96	98	98	99	98	96	*--	--	--
BAYPORT	90	84	86	95	97	96	93	94	95	96	96	94
BLUE LAKE (POND)	78	66	75	--	--	--	--	--	--	--	--	--
BLUE LAKE	--	--	91	94	96	95	96	96	96	96	98	97
BURNSVILLE	75	72	*--	--	--	--	--	--	--	--	--	--
CHASKA	66	54	57	53	73	81	70	63	70	93	93	93
CHANHASSEN	75	*--	--	--	--	--	--	--	--	--	--	--
COTTAGE GROVE	82	78	66	71	85	86	90	86	91	95	96	96
EAGAN TOWNSHIP	72	61	*--	--	--	--	--	--	--	--	--	--
EMPIRE	--	--	--	--	--	--	--	--	98	99	99	99
EXCELSIOR	93	80	*--	--	--	--	--	--	--	--	--	--
FARMINGTON	73	74	76	79	88	90	86	82	75	*--	--	--
FOREST LAKE TOWNSHIP	--	--	*--	--	--	--	--	--	--	--	--	--
FOREST LAKE VILLAGE	41	37	*--	--	--	--	--	--	--	--	--	--
HASTINGS	97	97	92	87	90	90	90	92	91	90	91	87
INVER GROVE HEIGHTS	42	31	*--	--	--	--	--	--	--	--	--	--
LAKEVILLE	73	83	89	96	97	96	93	82	81	*--	--	--
LONG LAKE	83	84	92	89	79	82	86	85	88	79	*--	--
MAPLE PLAIN	68	79	89	90	86	88	91	96	94	93	95	94
MEDINA	92	88	88	91	91	96	88	96	91	83	86	88
METROPOLITAN	77	83	88	86	87	82	83	81	71	89	92	95
MOUND	80	82	74	80	*--	--	--	--	--	--	--	--
NEWPORT	66	50	56	56	51	*--	--	--	--	--	--	--
OAK PARK HEIGHTS	85	81	71	*--	--	--	--	--	--	--	--	--
ORONO	86	91	94	96	93	88	88	81	84	72	*--	--
PRIOR LAKE	89	82	86	80	86	80	80	88	*--	--	--	--
ROSEMOUNT (trickling filter)	72	87	83	*--	--	--	--	--	--	--	--	--
ROSEMOUNT AWTP	--	--	96	96	98	99	99	98	99	99	99	99
ST. PAUL PARK	78	75	83	82	80	*--	--	--	--	--	--	--
SAVAGE	91	96	95	94	95	95	94	94	93	99	97	97
SENECA	--	88	93	94	94	93	93	93	90	91	91	90
SHAKOPEE	38	*--	--	--	--	--	--	--	--	--	--	--
SOUTH ST. PAUL	93	94	93	92	*--	--	--	--	--	--	--	--
STILLWATER	80	90	90	93	97	93	93	94	91	88	94	94
VICTORIA	62	69	72	*--	--	--	--	--	--	--	--	--
WACONIA	--	--	--	--	82	86	84	89	*--	--	--	--
WAYZATA	72	*--	--	--	--	--	--	--	--	--	--	--
ALL PLANTS EXCEPT METRO (weighted avg.)	82	83	88	93	94	93	94	93	93	94	94	95
ALL PLANTS (weighted average)	78	83	88	87	88	83	84	84	75	90	92	95
ALL PLANTS EXCEPT METRO (actual average)	76	76	83	86	88	91	90	89	90	91	94	95
ALL PLANTS (actual average)	76	76	84	86	88	90	89	89	89	91	94	95

* Plant phased out during previous year.

TABLE A-7
INFLUENT BOD DATA 1971-1982

Treatment Plant	Annual Average Values, BOD (mg/l) 1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
ANOKA	182	223	240	237	189	170	175	199	206	176	211	223
APPLE VALLEY	211	235	220	228	204	189	228	216	194	*--	---	---
BAYPORT	225	286	229	282	330	270	228	200	198	197	184	161
BLUE LAKE	---	---	300	304	271	282	258	266	216	228	230	228
CHASKA	171	196	200	185	222	241	203	200	258	220	229	189
COTTAGE GROVE	279	260	250	234	222	197	209	198	172	171	204	208
EMPIRE	---	---	---	---	---	---	---	---	208	181	234	204
FARMINGTON	279	400	329	957	453	452	447	338	293	*--	---	---
HASTINGS	300	233	188	175	161	187	189	243	221	210	227	251
LAKEVILLE	144	150	213	426	373	570	432	290	257	*--	---	---
LONG LAKE	212	171	257	258	150	183	201	163	164	148	*--	---
MAPLE PLAIN	120	79	186	186	80	129	156	142	165	173	165	146
MEDINA	150	90	140	124	156	246	285	300	119	139	128	122
METROPOLITAN	247	267	256	256	241	266	246	215	205	215	208	203
NEWPORT	229	244	207	217	170	*--	---	---	---	---	---	---
ORONO	125	143	167	158	105	110	141	116	102	98	*--	---
PRIOR LAKE	189	118	140	111	104	110	76	103	*--	---	---	---
ROSEMOUNT	---	---	70	246	213	220	203	198	193	165	177	168
ST. PAUL PARK	550	274	248	227	224	*--	---	---	---	---	---	---
SAVAGE	138	217	175	184	191	163	283	179	130	151	153	151
SENECA	---	242	267	270	235	247	230	252	219	194	217	221
STILLWATER	89	106	108	157	161	140	116	146	118	121	141	135
WACONIA	---	---	---	---	169	676	341	*--	---	---	---	---
ALL PLANTS EXCEPT METRO (weighted avg.)					234	243	229	239	207	197	217	214
ALL PLANTS (weighted average)					240	263	243	219	205	212	209	205
ALL PLANTS EXCEPT METRO (actual average)					209	252	232	208	191	171	192	185
ALL PLANTS (actual average)					210	252	232	209	191	174	193	186

*Plant phased out during previous year.

TABLE A-8
INFLUENT TSS DATA 1971-1982

Treatment Plant	Annual Average Values, TSS (mg/l) 1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
ANOKA	240	300	267	302	234	195	176	164	132	141	152	154
APPLE VALLEY	258	329	320	378	300	229	271	274	240	*--	---	---
BAYPORT	220	269	200	326	317	227	147	144	169	191	165	150
BLUE LAKE	---	---	244	364	347	361	324	317	270	244	241	230
CAHSKA	212	190	184	194	226	292	180	180	195	167	189	167
COTTAGE GROVE	350	318	274	294	241	185	220	200	163	152	187	173
EMPIRE	---	---	---	---	---	---	---	---	226	190	251	212
FARMINGTON	259	296	225	361	250	223	235	189	147	*--	---	---
HASTINGS	333	333	225	198	199	207	184	252	223	224	235	233
LAKEVILLE	174	212	327	849	997	876	759	388	365	*--	---	---
LONG LAKE	206	294	288	446	187	261	274	195	210	196	*--	---
MAPLE PLAIN	63	62	118	193	83	134	182	228	233	209	179	199
MEDINA	138	125	133	141	214	365	385	487	205	151	132	127
METROPOLITAN	313	318	308	317	316	332	288	231	222	237	230	241
NEWPORT	250	248	218	248	181	*--	---	---	---	---	---	---
ORONO	136	167	167	235	168	146	176	167	140	154	*--	---
PRIOR LAKE	255	183	193	123	180	139	83	149	*--	---	---	---
ROSEMOUNT	---	---	50	230	258	230	226	235	202	236	221	239
ST. PAUL PARK	318	308	276	270	241	*--	---	---	---	---	---	---
SAVAGE	267	700	280	269	278	241	249	265	190	565	234	170
SENECA	---	242	243	319	282	225	209	240	204	186	211	203
STILLWATER	115	120	130	193	210	140	118	158	119	127	159	139
WACONIA	---	---	---	---	187	381	270	*--	---	---	---	---
ALL PLANTS EXCEPT METRO (weighted avg.)					292	264	243	255	219	204	218	206
ALL PLANTS (weighted average)					313	323	281	235	221	232	228	235
ALL PLANTS EXCEPT METRO (actual average)					266	266	246	235	202	209	197	184
ALL PLANTS (actual average)					268	269	248	235	203	211	199	188

*Plant phased out during previous year.

TABLE A-9

STATISTICAL ANALYSES OF BIOCHEMICAL OXYGEN DEMAND DATA
FOR PLANTS IN OPERATION DURING 1982

TREATMENT PLANT EFFLUENT STATISTICAL DATA

Treatment Plant	BIOCHEMICAL OXYGEN DEMAND, mg/l*																	
	50% of Time						75% of Time						90% of Time					
	1977	1978	1979	1980	1981	1982**	1977	1978	1979	1980	1981	1982**	1977	1978	1979	1980	1981	1982**
ANOKA	7	11	12	12	15	10	10	16	16	17	20	14	13	22	22	22	26	19
BAYPORT	7	6	6	5	7	7	10	10	8	8	8	9	16	14	11	11	10	13
BLUE LAKE	10	11	7	8	9	10	15	14	10	10	13	13	20	22	15	14	19	16
CHASKA	33	61	93	14	14	12	58	100	160	22	24	16	98	140	210	38	34	22
COTTAGE GROVE	31	28	12	10	9	8	44	38	20	14	15	13	69	52	50	18	20	18
EMPIRE	--	--	4	2	3	2	--	--	10	2	4	3	--	--	28	5	4	4
HASTINGS	13	16	16	17	18	17	19	22	22	22	24	27	29	28	28	31	33	37
MAPLE PLAIN	8	7	16	19	10	11	17	14	23	29	15	18	26	22	33	37	21	26
METROPOLITAN	40	40	36	20	14	10	51	53	53	29	24	15	62	64	71	44	36	22
ROSEMOUNT	12	11	10	11	12	15	18	15	15	14	15	18	23	22	20	20	19	24
SAVAGE	20	26	26	5	9	6	30	34	41	7	12	9	42	42	59	9	15	20
SENECA	14	18	14	14	19	17	20	25	18	20	22	21	28	39	27	25	30	25
STILLWATER	8	8	8	12	14	10	14	14	12	14	24	12	24	18	21	19	33	14

* The data shows that for the percent of time shown, the effluent concentration was less than or equal to the tabulated values.

**1982 data represents CBOD values.

TABLE A-10

STATISTICAL ANALYSES OF TOTAL SUSPENDED SOLIDS EFFLUENT DATA
FOR PLANTS IN OPERATION DURING 1982

TREATMENT PLANT EFFLUENT STATISTICAL DATA

Treatment Plant	TOTAL SUSPENDED SOLIDS, mg/l*																	
	50% of Time						75% of Time						90% of Time					
	1977	1978	1979	1980	1981	1982	1977	1978	1979	1980	1981	1982	1977	1978	1979	1980	1981	1982
ANOKA	12	13	10	10	12	7	16	20	15	15	18	10	21	28	21	20	24	15
BAYPORT	10	8	7	7	7	7	12	10	10	9	9	9	15	12	13	11	10	12
BLUE LAKE	11	13	11	8	6	6	17	28	14	11	7	8	20	22	17	15	9	10
CHASKA	36	58	43	11	13	10	71	88	83	15	16	14	121	120	130	18	22	19
COTTAGE GROVE	12	17	10	7	5	6	22	28	16	13	8	10	44	51	28	22	14	14
EMPIRE	--	--	3	1	1	1	--	--	5	3	1	1	--	--	11	4	2	2
HASTINGS	16	18	17	22	19	28	24	26	24	30	28	38	29	33	31	38	36	48
MAPLE PLAIN	7	6	10	11	6	6	24	12	18	15	8	10	42	40	30	24	16	16
METROPOLITAN	40	37	43	15	10	7	53	55	85	33	24	12	88	78	137	60	47	21
ROSEMOUNT	2	3	2	2	1	1	3	5	3	3	2	2	5	7	5	3	3	4
SAVAGE	10	14	10	4	5	2	16	20	18	7	12	5	29	25	28	15	17	11
SENECA	14	14	13	15	19	19	18	19	24	19	23	23	22	27	32	23	28	26
STILLWATER	7	10	10	9	8	8	10	14	12	14	12	10	13	18	16	21	15	12

*The data shows that for the percent of time shown, the effluent concentration was less than or equal to the tabulated values.

TABLE A-11

1982 METRO PLANT SLUDGE QUANTITY

QUANTITY	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	TOTAL	AVERAGE
Sludge Production Wet Tons														
F&I No.1 V.F. Cake	9,974	8,541	11,597	12,298	12,512	9,563	11,828	10,046	9,004	4,973	0	0	100,336	8,361
F&I No.2 V.F. Cake	12,840	11,867	14,685	13,055	13,898	10,543	11,109	9,122	8,427	8,708	7,775	9,922	131,951	10,996
Filter Press Cake	1,840	1,937	2,061	1,936	1,968	1,990	2,086	1,995	1,935	3,375	4,515	5,886	31,524	2,627
Roll Press Cake	-	-	-	-	-	-	-	-	-	3,819	7,248	9,713	20,780	1,732
Total	24,654	22,345	28,343	27,289	28,378	22,096	25,023	21,163	19,366	20,875	19,538	25,521	284,591	23,716
Dry Tons (Total)														
F&I No.1 V.F. Cake	2,822	2,562	3,368	3,556	3,693	2,681	3,300	2,699	2,385	1,293	0	0	28,359	2,363
F&I No.2 V.F. Cake	2,756	2,744	3,688	3,300	3,313	2,685	2,818	2,396	2,258	2,267	2,071	2,710	33,006	2,750
Filter Press Cake	871	931	1,024	848	947	917	1,021	961	950	1,579	2,118	2,695	14,862	1,239
Roll Press Cake	-	-	-	-	-	-	-	-	-	995	1,981	2,564	5,540	461
Total	6,449	6,237	8,080	7,704	7,953	6,283	7,139	6,056	5,593	6,134	6,170	7,969	81,767	6,813
Dry Ton (Sludge Solids)														
F&I No.1 V.F. Cake	2,527	2,297	3,053	3,257	3,360	2,408	2,963	2,383	2,096	1,116	0	0	25,460	2,122
F&I No.2 V.F. Cake	2,148	2,116	2,480	2,395	2,343	1,965	1,971	1,733	1,519	1,589	1,523	2,073	23,855	1,988
Filter Press Cake	871	931	1,024	848	947	917	1,021	961	950	1,579	2,118	2,695	14,862	1,239
Roll Press Cake	-	-	-	-	-	-	-	-	-	995	1,981	2,564	5,540	461
Total	5,546	5,344	6,557	6,500	6,650	5,290	5,955	5,077	4,565	5,279	5,622	7,332	69,717	5,810
Sludge Disposal Wet Tons														
F&I No.1 Incin.	8,603	7,457	4,668	12,298	8,226	8,700	11,748	8,972	5,138	0	0	0	75,810	6,318
F&I No.1 Loadout	1,371	1,084	6,929	0	4,286	863	80	1,074	3,866	4,973	0	0	24,526	2,044
F&I No. 2 Loadout	12,840	11,867	14,685	13,055	13,898	10,543	11,109	9,122	8,427	8,708	7,775	9,922	131,951	10,996
Press Cake Incin.	-	-	-	-	-	-	-	-	-	377	349	-	726	60
Press Cake Loadout	1,840	1,937	2,061	1,936	1,968	1,990	2,086	1,995	1,935	2,998	4,166	5,886	30,798	2,567
Roll Cake Incin.	-	-	-	-	-	-	-	-	-	-	826	-	826	69
Roll Cake Loadout	-	-	-	-	-	-	-	-	-	3,819	6,422	9,713	19,954	1,663
Total Incineration	8,603	7,457	4,688	12,298	8,226	8,700	11,748	8,972	5,138	377	1,175	0	77,362	6,447
Total Loadout	16,051	14,888	23,675	14,991	20,152	13,396	13,275	12,191	14,228	20,498	18,363	25,521	207,229	17,269
Dry Tons (Sludge Solids)														
F&I No.1 Incin.	2,180	2,005	1,229	3,257	2,209	2,191	2,943	2,128	1,196	0	0	0	19,338	1,612
F&I No.1 Loadout	347	292	1,824	0	1,151	217	20	255	900	1,116	0	0	6,122	510
F&I No.2 Loadout	2,148	2,116	2,480	2,395	2,343	1,965	1,971	1,733	1,519	1,589	1,523	2,073	23,855	1,988
Press Cake Incin.	0	0	0	0	0	0	0	0	0	171	140	0	311	26
Press Cake Loadout	871	931	1,024	848	947	917	1,021	961	950	1,408	1,978	2,695	14,551	1,213
Roll Cake Incin.	-	-	-	-	-	-	-	-	-	0	245	0	245	20
Roll Cake Loadout	-	-	-	-	-	-	-	-	-	995	1,736	2,564	5,295	441
Total Incineration	2,180	2,005	1,229	3,257	2,209	2,191	2,943	2,128	1,196	171	385	0	19,894	1,658
Total Loadout	3,366	3,339	5,328	3,243	4,441	3,099	3,012	2,949	3,369	5,108	5,237	7,332	49,823	4,152

TABLE A-12

1982 METRO PLANT SLUDGE QUALITY

	Solids %	Volatiles %	TKN %	NH3-N %	P %	Cd	Cu	Ni	Pb	Zn	Cr	K	Hg	PCB
F & I No. 1 Vacuum Filter Cake														
January	28.2	59.6	2.6	.04	1.2	43	726	166	292	1,574	546	796	1.8	1.5
February	29.5	58.4	2.2	.07	0.9	43	751	180	350	1,351	748	849	1.6	1.4
March	28.0	59.5	2.3	.03	1.0	39	706	144	360	1,289	545	823	1.3	0.9
April	28.4	59.9	2.3	.09	1.0	44	723	126	361	1,397	719	791	1.9	0.6
May	27.0	62.0	2.7	.05	1.2	35	706	134	427	1,314	1,344	1,029	1.6	1.2
June	27.8	56.3	3.3	.02	1.1	32	773	151	334	1,305	889	726	1.5	0.7
July	26.9	54.7	2.7	.03	1.1	39	758	163	266	1,225	749	809	1.1	0.5
August	27.3	62.1	2.4	.03	1.0	38	1,018	228	299	1,246	733	757	1.4	1.0
September	25.8	57.3	3.3	.02	1.1	34	896	217	250	1,247	753	781	1.2	0.8
October	27.4	57.7	3.3	.07	1.1	29	775	181	204	1,221	830	776	1.9	1.1
November														
December														
Average	27.6	58.8	2.7	.04	1.1	38	783	169	314	1,317	786	814	1.5	1.0
F & I No. 2 Vacuum Filter Cake														
January	21.8	54.0	4.3	.10	1.9	54	861	170	334	1,769	742	1,234	2.6	0.97
February	23.0	49.6	3.4	.09	1.5	48	929	215	375	1,640	844	1,242	2.4	0.92
March	25.2	46.0	3.0	.07	1.5	56	1,099	189	507	1,840	999	1,425	1.2	1.34
April	25.4	48.4	3.1	.07	1.5	46	898	158	458	1,531	952	1,155	1.5	1.02
May	24.1	51.0	3.7	.06	1.5	37	766	139	468	1,501	1,232	1,240	3.6	1.10
June	25.6	53.2	3.6	.03	1.5	34	838	130	383	1,365	918	884	2.3	0.72
July	25.6	53.7	3.0	.04	1.3	34	694	125	223	1,098	635	769	1.2	0.40
August	26.5	55.8	3.2	.04	1.4	44	1,068	198	284	1,535	856	880	---	1.02
September	27.2	51.2	3.2	.04	1.4	42	1,435	413	252	1,295	962	849	1.9	1.20
October	26.2	52.9	3.4	.04	1.5	38	819	169	219	1,282	997	896	2.5	0.98
November	27.6	55.3	2.8	.03	1.2	28	623	131	204	1,111	883	836	1.2	0.89
December	27.6	56.4	2.3	.06	1.1	29	695	120	184	1,165	1,009	1,019	1.2	0.67
Average	25.5	52.3	3.2	.06	1.4	41	894	180	325	1,428	919	1,036	2.0	0.94
Plate & Frame Press Cake														
January	46.6	67.1	3.8	.20	3.5	109	1,755	276	403	3,489	1,420	1,077	2.9	1.4
February	48.4	66.3	3.6	.09	2.9	102	1,681	245	421	2,896	1,712	970	2.8	1.7
March	50.0	60.5	2.9	.09	2.6	100	1,715	231	574	3,014	1,661	1,318	2.1	1.9
April	46.0	63.5	3.2	.09	2.8	85	1,168	180	439	2,318	1,525	909	1.2	2.3
May	47.5	62.1	3.3	.09	2.9	74	1,310	183	443	2,683	2,021	1,100	1.9	1.7
June	47.7	63.8	3.3	.05	3.0	87	1,637	183	438	3,082	2,135	840	2.7	2.5
July	48.7	62.6	3.1	.09	2.8	84	1,418	202	357	2,272	1,519	676	3.0	0.4
August	48.0	63.7	3.5	.05	3.0	91	1,765	250	405	2,785	1,529	667	2.8	1.1
September	50.1	63.0	3.2	.05	2.6	80	1,656	262	386	2,397	1,464	867	2.1	2.5
October	47.2	65.3	3.7	.05	2.6	85	1,613	226	357	2,491	1,755	931	2.7	2.7
November	46.8	66.7	3.4	.09	2.8	84	1,602	217	391	2,833	2,282	982	3.2	1.6
December	46.9	70.0	3.4	.11	2.7	87	1,573	208	342	2,679	2,071	916	2.0	0.8
Average	47.8	64.6	3.4	.09	2.8	89	1,574	222	413	2,745	1,758	938	2.4	1.7
Roll Press Cake														
January														
February														
March														
April														
May														
June														
July														
August														
September														
October														
November	25.7	71.4	2.5	.51	1.1	27	677	121	222	1,284	677	1,066	1.9	0.5
December	24.4	77.2	2.3	.20	0.9	25	779	102	172	1,025	922	1,230	1.6	0.45
Average	25.0	74.3	2.4	.36	1.0	26	728	112	197	1,154	800	1,148	1.8	0.5

TABLE A-13

METROPOLITAN WASTE CONTROL COMMISSION

1982 OUT-PLANT SLUDGE QUANTITY

TREATMENT PLANT	JAN.	FEB.	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	TOTAL GALLONS	AVERAGE GALLONS
ANOKA														
Gallons x 1,000	355.2	345.6	293.0	390.4	348.0	294.0	371.2	268.8	352.0	435.2	272.0	262.4	3,987,800	332,300
Dry Tons	21.6	24.4	24.4	30.9	25.8	23.5	26.8	25.1	28.6	29.6	15.1	19.5	295.3	24.6
BAYPORT														
Gallons x 1,000	99.2	92.8	106.6	103.8	104.0	120.2	104.6	121.0	90.0	88.6	121.2	90.0	1,242,000	103,500
Dry Tons	9.4	8.8	10.4	10.1	10.2	11.2	9.9	10.1	7.2	6.8	10.5	7.2	111.8	9.3
BLUE LAKE														
Gallons x 1,000	2,625.0	2,970.0	3,240.0	2,935.0	3,250.0	3,110.0	3,235.0	2,715.0	3,115.0	3,520.0	3,290.0	3,120.0	37,125,000	3,093,800
Dry Tons	533.1	568.5	749.8	689.1	712.9	696.4	723.1	595.5	593.6	603.3	559.7	568.6	7,593.6	632.8
CHASKA														
Gallons x 1,000	160.0	250.0	218.0	205.0	330.0	270.0	225.0	194.1	200.0	230.0	160.0	195.0	2,637,100	219,800
Dry Tons	11.8	18.2	16.4	13.6	23.4	18.2	13.1	13.2	11.7	14.6	8.9	12.3	175.4	14.6
COTTAGE GROVE														
Gallons x 1,000	208.0	151.2	224.0	390.4	217.6	364.8	343.2	377.6	313.0	294.4	326.4	267.2	3,477,800	289,820
Dry Tons	14.8	10.0	18.3	28.3	14.2	24.3	20.3	23.8	19.4	20.4	22.5	18.2	234.5	19.5
HASTINGS														
Gallons x 1,000	204.4	87.0	292.2	220.8	131.2	198.0	183.0	252.0	382.6	259.2	294.4	252.8	2,757,600	229,800
Dry Tons	27.6	11.7	36.6	26.1	17.5	28.2	27.2	31.5	42.6	34.3	38.2	28.6	350.1	29.2
MAPLE PLAIN														
Gallons x 1,000	-	-	4.0	4.0	-	16.0	4.0	32.0	-	-	-	-	60,000	5,000
Dry Tons		-	1.0	1.0		3.9	1.0	7.9					14.8	1.2
ROSEMOUNT														
Gallons x 1,000	129.0	108.0	149.0	132.5	103.5	130.0	109.0	112.3	107.0	111.5	129.1	129.0	1,449,900	120,800
Dry Tons	62.0	50.7	47.1	44.8	46.5	47.8	44.2	53.2	54.7	55.5	53.5	57.6	617.6	51.5
SAVAGE														
Gallons x 1,000	-	18.0	-	-	12.8	57.6	12.0	70.4	6.4	34.0	-	40.0	251,200	20,930
Dry Tons		3.7		-	3.9	9.3	2.4	12.2	1.3	6.1		8.1	47.0	3.9
STILLWATER														
Gallons x 1,000	315.8	304.0	365.4	398.6	603.8	548.6	495.6	480.8	453.6	292.8	402.2	389.6	5,050,800	420,900
Dry Tons	27.5	31.8	48.5	53.4	65.5	56.7	53.1	55.3	44.1	35.7	39.4	52.0	563.0	46.9

TABLE A-14

1982 SENECA PLANT SLUDGE QUANTITY

QUANTITY	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	TOTAL	AVERAGE
Wet Tons	3,682	4,271	4,668	5,159	4,440	4,992	5,168	4,349	4,241	4,351	4,139	4,343	53,803	4,484
Dry Tons	868	1,005	1,115	1,187	1,023	1,188	1,201	867	948	1,025	974	1,001	12,402	1,034

TABLE A-15

1982 SENECA PLANT SLUDGE QUALITY

	Solids %	Volatiles %	TKN %	NH3-N %	P %	Cd	Cu	Ni	Pb	Zn	Cr	K	Hg	PCB
Seneca Cake														
January	23.4	46.7	3.5	.07	1.5	6.8	1,219	481	245	476	529	929	2.3	---
February	24.6	46.5	3.3	.06	1.1	6.9	1,190	212	311	537	294	729	2.3	0.7
March	24.1	46.3	2.8	.06	1.3	6.4	1,129	242	342	549	446	940	2.5	1.0
April	23.1	50.6	3.2	.08	1.4	9.2	1,267	97	407	645	344	1,006	2.2	1.1
May	23.7	49.6	3.2	.07	1.5	7.3	1,040	84	472	590	346	894	2.9	1.0
June	23.9	48.7	2.9	.07	1.4	8.2	1,121	92	439	599	281	814	3.9	0.9
July	23.9	48.9	3.0	.06	1.2	10.1	1,004	74	364	1,009	183	764	1.8	0.2
August	20.5	36.9	2.2	.05	1.2	13.4	574	83	232	423	182	788	3.6	0.3
September	23.2	43.9	2.9	.05	1.2	10.7	633	66	217	434	235	854	2.2	0.6
October	23.2	50.4	3.6	.05	1.3	12.7	751	49	194	442	278	923	1.9	0.2
November	24.4	45.1	3.3	.06	1.3	11.1	602	58	189	387	226	795	1.8	0.2
December	23.5	42.5	2.5	.07	1.2	11.5	745	156	179	409	270	864	1.6	0.2
Average	23.5	46.3	3.0	.06	1.3	9.5	940	141	299	542	301	858	2.4	0.6

DATE	ISSUED TO